



limited McBurney's incision was applied and it was tried to bring out the appendix by a pull in the coecum. In the case of gangrene with limited accumulation of pus drainage was undertaken, but not so in the case of diffuse peritonitis, and irrigation was not applied. During the after-treatment subcutaneous or intravenous saline injections were given, like in other hospitals also permanently if necessary. Enteric lavage was used a great deal to further the peristalsis, but laxatives were not given for the first 4 or 5 days. Of late years also treatment with opium has been tried at peritonitis. Enterostomy carried out in local anesthesia was applied a great deal in particularly severe cases, sometimes with success. Even in apparently hopeless cases the operation may be life saving, because we never know with certainty whether the intestine may not recover its power of contraction when it is relieved. But one must of course not hesitate too long if the operation shall have a favourable effect. All the enterostomies were secondary, primary enterostomies were never done.

Examination of plasma chlorides, bicarbonate, and serum protein was not carried out in our Department till after 1940.

The results appear from the concomitant tables, to which we shall only attach a few remarks.

By taking 2 so long periods for comparison as decennial periods must be said to be, we have thought it possible to guard ourselves against the erroneous conclusions that may be due to an irregular distribution of the severe cases, if a comparison is made from a material comprising only a few years.

It appears from the statement that there were undertaken almost twice as many operations for acute appendicitis within the decennium of 1931—1940 as within the preceding period. This is to some extent due to the constant growth of the hospital, but probably also to the fact that of late years nearly all cases of appendicitis have been admitted to hospital.

The figures from the former 10 years give in all likelihood a somewhat too gloomy picture of this period, because the patients were then to a far greater extent than now treated at home being often not admitted till there began to appear signs of peritonitis. A number of light cases, which were cured by conservative treatment at home, were thus not included in the statistical statement, a fact which must naturally weigh upon the mortality percentage. To form a picture of the value of the serum therapy it is therefore of no use to fix exclusively on the gratifying de-

# ACTA CHIRURGICA SCANDINAVICA

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SUB TITULO

NORDISKT MEDICINSKT ARKIV

CONDIDIT MDCCCLXIX AXEL KEY

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REDACTORES

*R. FALTIN*

Helsingfors

*AAGE NIELSEN*

Århus

*J. HOLST*

Oslo

*EINAR KEY*

Stockholm

*S. KJÆRGAARD*

København

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morrhagic diathesis, whereas vitamin medication during the phase of cystitis membranacea did not elicit any signs indicative of any therapeutic effect. In some of the author's cases removal of the focal infection seemed to induce a turn for the better in the course of the disease. According to the author, the symptoms in severe cases seem to justify sympathetic denervation of the urinary bladder.

Report of a case of disk-rupture that had occurred intradurally causing paraplegia and paralysis of the urinary bladder and which was successfully removed by surgical intervention.

### Résumé.

En l'espace de 1½ an, entre 1942 et 1943, j'ai rencontré 10 cas de purpura des voies urinaires. Les deux points que voici ont caractérisé le tableau clinique: 1°) une hématurie initiale plus ou moins abondante; 2°) une pyurie aseptique consécutive, durant des semaines, voire des mois, donnant des symptômes assez marqués d'irritation vésicale, et suivie à son tour d'une sécrétion fibrineuse considérable, ce qu'on nomme la cystite membraneuse. C'est seulement pendant l'hématurie initiale que les constatations cystoscopiques sont nettes et typiques. Au stade de cystite membraneuse l'examen endoscopique ne fournit pas de certitude diagnostique. Trois des cas représentaient le purpura simplex et guérissent rapidement, 6 étaient des formes sévères qui durèrent jusqu'à une demi-année, et le dernier récidiva trois fois en dix ans pour mourir finalement de pneumonie postopératoire. Deux cas appartenaient avant tout au type rénal douloureux, et deux montraient les symptômes d'une extension du processus pathologique à l'urètre.

Quatre de mes cas souffraient en même temps de polyarthrite, et chez l'un il y avait en outre une iritis rhumatismale. Les divers facteurs étiologiques producteurs de la diathèse hémorragique, tels que thrombocytopénie, hypovitaminose C et infections rhumatoïdes septiques, apparurent souvent simultanément. Vue sous cet angle la pathogénie de l'infection doit être complexe, en ce sens que deux groupes de facteurs exercent leur action: d'une part ceux qui augmentent la prédisposition, et de l'autre ceux qui provoquent des attaques manifestes du mal. C'est par l'effet des carences vitaminiques, qui accentuent la prédisposition, qu'on explique le mieux le net accroissement de fréquence de ces cas en

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prostate may be a focus from which the urine may become infected, in other words, whether the bacteria present in the prostate gland at a later point of time may be traced in the urine.

In the course of our work a question of great practical importance turned up, namely of the route by which the urine becomes infected after prostatectomy. Theoretically there are many possibilities: 1) infection through urethra, 2) infection from the skin, 3) infection from the intestine via the blood (or lymph), 4) infection from the air, 5) infection from fingers, throat and nose of the surgeon or from his instruments, 6) infection from the solution used for irrigation or from the rubber tubes, 7) infection from a focus in the prostate gland and 8) infection from a previously infected upper urinary tract.

Perhaps even more theoretical possibilities may be suggested. However our own examinations proved to us that the question is not from where the urine may be thought infected on rare occasions. The problem is where to find the highroad by which infection of a pure intestinal flora is carried to every urine and in immediate connection with removal of the prostate gland.

We have chosen to investigate two of these possibilities, namely urethra and the skin. It was a matter of proving whether the intestinal bacteria is first present in urethra (resp. skin) and next in the urine, or first in the urine and next in urethra (resp. skin).

We did not succeed in giving any positive contribution to determination of the infectional route that in our opinion is the probable one, namely infection from the intestine via blood or lymph, either through the general circulation and the kidney, or through regional blood or lymph routes directly from rectum. Blood cultures were made however, for if on a modest scale to investigate this possibility.

Finally, bacteriologic examinations were made in a few cases of postoperative epididymitis.

The postoperative epididymitis that occurs in 20—25 % of all prostatectomies without preceding vasectomy lead on rare occasions to formation of abscess. Such a case of abscess formation appeared in our material, and therefore smear was taken from a punctate to see whether the bacteria found in epididymitis are the same ones which are found in the urine.

It should be stated at once that the conclusions drawn from our findings only apply to the conditions under which we have

## 10 Years of Serum Therapy of Appendicitis.

By

C D BARTELS and ERIK MANICUS-HANSEN

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WEINBERG, the well-known French bacteriologist, was the first to call attention to the parallelism between the bacterial flora of appendicular peritonitis and that of gas phlegmons, and accordingly the first to recommend serum therapy with gas gangrene serum in gangrenous and perforated appendicitis

In a paper dated 1928 WEINBERG treats the bacteriology in 160 cases of acute and gangrenous appendicitis, giving an exhaustive description of the entire bacterial flora, both aerobic and anaerobic

His paper is divided into several parts. Thus there is partly the isolation of the individual species of bacteria, partly an investigation as to which combinations of bacteria occur most frequently. WEINBERG attached great importance to the so-called "bacterial associations", which means the liability of the anaerobic germs to ally with other anaerobic or aerobic microbes, thus obtaining increased virulence. Further the importance and the virulence of the individual species and bacteria associations were tested by means of animal experiments.

WEINBERG found by cultivation a bacterial flora that was in the main alike in simple and gangrenous appendicitis. He demonstrated altogether 14 aerobic and 14 anaerobic strains, which differed considerably in frequency and occurrence. Thus among the aerobic strains colibacilli were by far the most frequent, and next followed enterococci, streptococci and staphylococci. Streptococci, however, only in 14 cases. Among the anaerobic strains Welch-Fraenkel's bacillus was the most frequent, of rarer occurrence were the vibron septique, the bacillus histolyticus, and various anaerobic rods and cocci with doubtful pathogenic qualities.

## Number of cases

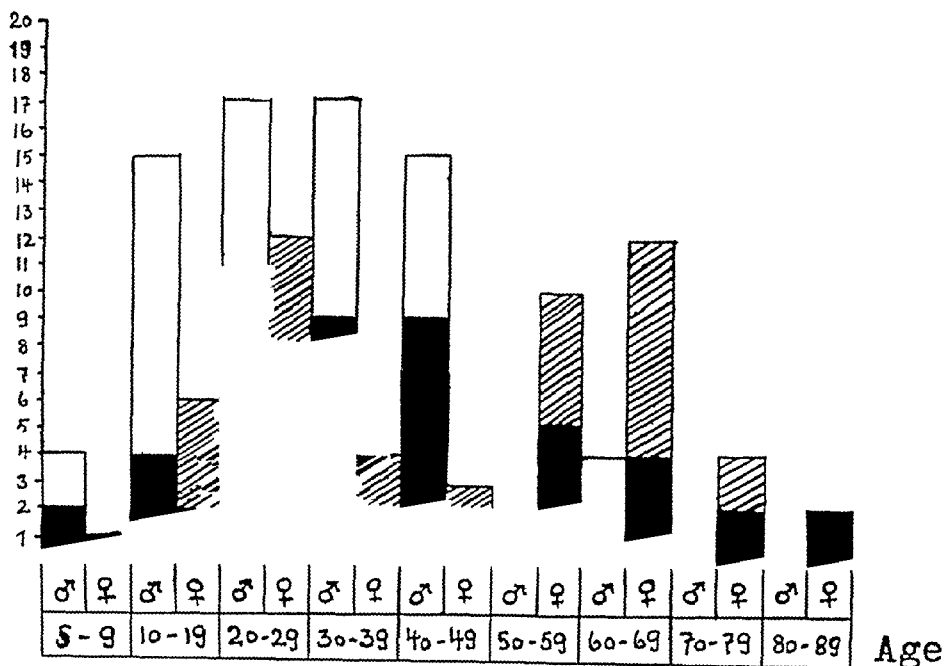


Fig 2 All the fractures by supination (127 cases) Distribution in age groups at the time of the accident (White areas = men, dotted = women The black parts = after examined patients The same method of designation is used for all diagrams of this type)

The difference between this figure and the mean age of the after-examined at the time of the accident ( $37.6 \pm 2.5$  years) is 6.7 years This figure denotes the mean interval between the acci-

Table 3

Average treatment time, average time of immobilization and the time when the patients were first allowed to rest their weight on the foot after the accident (in days) for unimalleolar and bimalleolar fractures by supination

Fracture group	Average treatment time	Average time of immobilization	Time for first rest on the foot (in days from the beginning of the treatment)
	$M \pm \epsilon_n$	$M \pm \epsilon_n$	$M \pm \epsilon_n$
Unimalleolar fractures	$43.9 \pm 3.1$	$22.1 \pm 1.8$	$7.9 \pm 1.6$
Bimalleolar fractures	$88.9 \pm 10.9$	$47.5 \pm 3.8$	$25.6 \pm 7.1$

Through his animal experiments WEINBERG concluded that it is particularly the colibacilli and Welch-Fraenkel's bacilli that are pathogenic, whereas the other species serve mainly to increase the virulence of the bacteria with which they are associated. WEINBERG regarded two bacterial associations as particularly frequent of occurrence and particularly dangerous

- 1) Colibacilli + Welch-Fraenkel's bacillus
- 2) Colibacilli + enterococci

Appendicitis is in WEINBERG's opinion seldom brought about by a single bacterium. It is an infection produced by a great number of different bacteria in greatly varying connections.

WEINBERG recommended the use of gas gangrene serum with admixture of coli serum for appendicitis.

The gas gangrene serum delivered from the Pasteur Institute, Paris, consists of the same antitoxins in a similar proportion as the Danish serum, the composition of which will be discussed later. As a matter of course a specific response can be expected only in the cases in which the peritonitis is due to one of the bacilli whose antitoxin is represented in the compound (most often Welch's bacillus and the colibacillus), but WEINBERG emphasizes that it is not absolutely necessary to give antitoxin against all of them. It often suffices to neutralize the most dominating and most pathogenic microbe, for by so doing the association of the bacteria is broken and the way paved for the process of healing.

In Germany KATZENSTEIN (1927) introduced a polyvalent coli serum, obtained by means of filtrates of selected toxic coli strains, for intravenous and intraperitoneal injection against peritonitis. Later also the significance of the anaerobic bacteria has been pointed out by German investigators, who like WEINBERG have demonstrated the presence of anaerobic germs in the vermiform appendix and in perforative peritonitis.

From the well-known German bacteriologist Professor Zeissler's Institute at Altona, LOHR & RASSIGL published a paper in 1931 titled *Die Bacteriologie der Wurmfortsatz Entzündung und der appendiculären Peritonitis*. The authors have investigated 130 cases of appendicitis, both phlegmonous, gangrenous and apparently normal, derived from different departments in different parts of Germany. A careful examination was made of the entire bacterial flora, the aerobic as well as the anaerobic, by direct microscopy and cultivation, and finally it was tried to

more to resorption of the inflammatory processes around the tumor than to a change in the growth itself. Consequently radical operation for a perforating cancer is not necessarily out of the question, if, as in these cases, the patient survives the peritonitis.

In two other cases the perforation occurred to the periproctitic soft parts.

*Case 4* A woman of 22 years had lumbar pain reaching down to the coccyx, as well as fever, vomiting and diarrhea at the end of January 1940. Medicine was prescribed by a physician, and the patient had no further symptoms until March, when she had a second attack complicated by an infiltration to the left of the anus. Three incisions were made at another hospital. Tumor was strongly suspected in view of the size of the periproctitic infiltration, and biopsy was done. However, histologic examination revealed only inflammation and no tumor. The patient was discharged as inoperable.

The incisions never healed, and in July a new "boil" developed in the midline over the sacrum. Bowel movements were normal. The patient was admitted to our Department in August, eight months after the appearance of the first symptoms. She was then cachectic with decubital sores on both hips. Just beyond the sphincter could be palpated an ulcerated, almost circular tumor, only part of the upper margin of which could be reached. Biopsy disclosed voluminous vegetations comprising a coarsely constructed adenocarcinoma. Colostomy was done, but the cachexia progressed and the patient died. Autopsy showed cancer of the rectum with cancerous ulcerative fistulas and severe cachexia.

*Case 5* A man of 34 years had for several years had hemorrhoids, which during the past year had increased in size and caused the patient trouble in the form of pain on defecation, a sensation of fullness in the rectum, and a nagging pain radiating to the lumbar spine and the anus. The stools varied in consistency and were mixed with blood and mucus. For the past three months the patient had difficulty in holding back the stools. Two months prior to admission he consulted a physician who prescribed medicine. On admission the patient was thin, pale and weak and exhibited rather pronounced cachexia. No hemorrhoids were visible, but a fistular opening was found about two centimeters from the anus. The wall of the rectum was rigid and nodular on palpation. Biopsy revealed ulcerating adenocarcinoma. The patient was treated with roentgen, but died after a short time. Autopsy confirmed the diagnosis.

The picture presented by Case 5, seems typical of cancer of the rectum, and it is difficult to understand why the correct diagnosis was not made by the physician first consulted. However, the anal fistula was probably considered a reasonable explanation of the symptoms, and rectal palpation was probably not done.

draw a comparison between the clinical and the bacteriological conditions •

LOHR and RASSFELD have found almost the same bacteria as WEINBERG, only they demonstrated a somewhat greater number of anaerobic species, most of them apathogenic. This examination also showed Welch-Fiaenkel's bacillus and the colibacillus to be the most frequently occurring species. They found altogether 29 different species. This flora was by the authors regarded as the "native flora" of the vermiform appendix, it was found comparatively regularly in the examined normal appendices.

The affected appendix proved to contain the same germs as the normal, but in addition the authors could demonstrate the presence of different pathogenic streptococcus species, hemolytic as well as anhemolytic, which were not found in the normal, and which they were therefore inclined to regard as the original cause of appendicitis. This fact cannot, however, be said to have been proved.

These pathogenic streptococci must not be confounded with or identified with the enterococci. Unlike ASCHOFF the authors regard it as extremely doubtful whether the enterococci have any pathogenic qualities whatever.

In severe gangrenous forms of appendicitis the "native flora" is still the sole prevailing one, there occur no new species, the culture is rather poorer in species than under normal conditions.

The putrid smell is due to putrefactive bacteria and colibacilli.

At gangrenous cases actinomycetes occur in particular abundance. They are found in great numbers on the surface of the fecaliths and the bed of the latter in the mucous membrane of the appendix. The fecaliths themselves consist, as is well-known, of a mesh-work of actinomycetes forming the stroma with embedded more or less incrustated fecal particles. They form an exact parallel to the salivary calculi, which according to SODERLUND likewise consist of a network of actinomycetes enclosing calcium salts precipitated from the saliva.

Actinomycetes grow very slowly, so accordingly they can only develop in great numbers in such appendices as have for some length of time been put out of action, and in which there is stagnation of the contents. The actinomycetes giving rise to the formation and growth of fecaliths they are in reality very dangerous visitors to shelter. Very slowly and often without any symptoms

quantity of mucicarminofilous substance is found here. Here and there slight regressive changes are observed in the tumour tissue and also an increased mucous content, resulting in adenoid structures. The histological aspect of the tumour well agrees with that of a *benign, encapsulated fibroepithelial tumour, belonging to the group of mucous and salivary gland tumours*. To all appearances the tumour emanated from the mucous glands of the bronchial mucous membrane, probably from their efferent ducts.

#### Case 4

K II 1360/41 A 44-year old woman

Previously well on the whole. Periodic cough since 1937 without being ill otherwise.

In Dec 1940 a slight hemoptysis, and since then slight hemoptyses several times during the menstrual periods.

Observed in sanatorium, where sputum tests and guinea-pig tests on sputum were negative, and no tubercle bacilli could be demonstrated in gastric lavages.

As the roentgenogram caused the suspicion of an obstructive atelectasis in the middle lobe, and also showed signs of a relative stenosis of valve-type in the anterior branch-bronchus of the left upper lobe, another roentgenogram was made after some time. Diagnosis: Stenosis of the bronchus of the middle lobe. On account hereof bronchoscopy was made on Aug 8, 1941, when a nodular, rounded, and slightly bleeding, firm tumour was seen growing in from the front at the level of the departure of the middle lobe bronchus. It practically filled the whole lumen of the bronchus at that level. Biopsy was made. Pathologic-anatomical diagnosis: Undifferentiated carcinoma. Therefore thoracotomy was performed on Aug 19, with incision acc. to CRAFOORD and extirpation of the 6th rib. Slight adhesions around the middle lobe and the apex of the lung. The rest of the lung free. These adhesions were cut. The pleura was incised around the hilus area. This area was palpated but no glands suspected of metastases could be felt. As it was considered to be a case of undifferentiated carcinoma, the best thing to do, was to extirpate the whole lung and to remove the glands completely. This operation was carried out as planned without any technical difficulties.

After resection of the peripheral cartilage in the bronchial stump, the bronchus was dealt with acc. to CRAFOORD with three isolated silk sutures, and between them a continuous catgut suture. Corner-invasion sutures were applied, and between them another two isolated sutures completed the invagination of the stump. Postoperative course uncomplicated. Primary healing.

*Macr. description.* In sections through the specimen fixed in a distended state, a cone-shaped uncapsuled polypoid tumour, the size of a cherry, is found in the lower lobe bronchus with its apex directed distally. Close to the tumour a lymphatic gland, the size of a hazelnut, with no signs of tumour infiltration is found. Around the tumour, the bronchus of the lower lobe is moderately cylindrically ectatic and filled with pus-mixed mucus.

whatever they prepare the way for a gangrenous or phlegmonous process in the appendix, after which a very inconsiderable cause is enough to bring about the process a slight swelling of the mucous membrane round the fecalith or a bend of the appendix are sufficient to make the retention complete, after which gangrene and perforation may set in in the course of a very short time

At perforative peritonitis we then have to do with the flora contained in the affected appendix, and we must count on infection in the peritoneum caused by a few of these bacteria — aerobic or anaerobic — or all of them. As, however, most of them are not pathogenic the number of bacteria causing appendicular peritonitis is in the general reduced to comprise only colibacilli and Welch-Fraenkel's bacilli (the combination by WEINBERG designated as particularly dangerous), together with the rarer forms of anaerobic bacilli (vibron septique, bacillus histolyticus, Novy's bacillus, contingently in co-operation with different kinds of streptococci)

It is therefore against these bacteria that the serum therapy must set in, but it must be remarked that the multivarious streptococcus picture possibly met with will make particular difficulties for the serum therapy

Though the serum therapy is thus already a rather old method of treatment, a general agreement has not yet been attained as to its value. The cause is, that nothing can be proved unless one works with large figures, and one cannot just compare the results from the different departments, because one cannot be sure of having to deal with homogeneous materials. The indications for operation and the setting up of the material are not the same in all cases, and the mortality percentage in the different statistical statements are therefore of but little significance as long as we do not know the contingent numbers of light cases

In Scandinavia the surgeons have generally regarded the serum therapy with great skepticism, less so, however, within recent years. In his introduction to the discussion on peritonitis at the meeting of the Scandinavian Surgical Society, 1935, BOHMANSSON declared that he had not been able to demonstrate any reduction in the mortality by serum therapy. But in a subsequent work (1941) BOHMANSSON had changed his view being now of opinion that the cause of the poor result must have been that

1931, on account of these symptoms, and a certain difficulty to breathe when moving fast.

Bronchoscopy disclosed a tumour about the size of the end of the thumb, with a granulated surface, just below the rima glottidis. The tumour grew into the lumen of the trachea from the right, in a backward direction. It was well isolated from its surroundings.

On Aug. 7th tracheostomy was performed and at the same time a piece was removed for microscopic examination. A tracheal cannula was inserted. *Pathologic-anatomical diagnosis:* Benign tumour of the same group as the mixed parotid tumours.

On Aug. 19th she was sent to Radiumhemmet for treatment. Treated there partly by local application of radium, partly with "canon". Improved steadily and acc. to the diary the tumour had completely disappeared by July 4th, 1932. According to entries during 1933 and the beginning of 1934, examinations disclosed neither signs of local relapse nor of metastases. In Dec. 1934 there is an entry saying that an induration was palpated to the right of the lower part of the larynx, and a slight right-sided paresis of the recurrent nerve could be established.

The patient died at home on July 17, 1936. No autopsy.

*Mic. examination.* The excised rounded, encapsulated tumour is partly coated with a low, regular squamous epithelium. It is of the mucous- and salivary-gland type with very pronounced cylindromatous structures. In the numerous rounded small lumina there is plenty of mucicarminofilous substance. The tumour cells are small and regular, the nucleus rounded and poor in chromatin. No mitoses can be found. In many places one can distinctly observe, that the nuclei are turned away from the interstitial, slightly hyaline connective tissue. (See Fig. 4.)

*Pathologic-anatomical diagnosis.* Fibroepithelial tumour belonging to the group of mucous- and salivary-gland tumours with pronounced cylindromatous structures. No signs of malignancy.

#### Case 6.

Ear diary No. 1270/32. A 41-year old man.

Since November 1930 he suffered from a slight shortness of breath, hoarseness and a feeling that something is in the way when breathing. The troubles have increased and during the past months he has had a feeling as if he had a foreign body in the trachea. No cough. No hemoptysis. 5 cm below the rima glottidis a tumour was found on the anterior wall constricting the lumen considerably. No visible ulceration.

May 3rd, 1932: operation. The tumour grew to the left through the tracheal wall into the space between the trachea and the oesophagus. Biopsy.

May 4th. Tracheotomy on account of breathing difficulties.

May 20th. Extirpation of a tumour, almost the size of an egg, together with the right part of the trachea from a point just above the jugulum up to the larynx. By plastic surgery most of the defect in the trachea was covered with skin. A cannula was inserted at the top.

Nov. 3rd, 1932. By another plastic operation the remaining defect in the tracheal wall was covered by a skin flap containing rib cartilage.

the doses used were too small (Behring's "Peritonitiss serum" + coli serum) Within the years 1939—1940 BOHMANSSON used large serum doses + sulfonamid, by which he succeeded in reducing the mortality at diffuse appendicular septic peritonitis very considerably BOHMANSSON and NORUP's treatise comprises, unlike several other treatises on serum therapy, a very great number of cases

KAPEL (1935), who has likewise used a combination of German "Peritonitiss serum" and coli serum, has by a comparison between a serum-treated material and two other not serum-treated materials in Denmark found no reduction of the mortality, neither as regards appendicitis with local peritonitis and abscess nor as regards diffuse peritonitis

The impossibility of comparing the published mortality percentages from different departments, on account of the apparent heterogeneity of the materials, has brought about that the various writers have now begun to compare the results within shorter periods from their own departments of treatment with and without serum respectively The figures are, however, generally so small that variations in the severity of the cases are possible

FOGH MOLLER (1941) presents a material of 115 cases of severe appendicitis-peritonitis 79 were treated with serum, 17 of whom died (21.5 per cent), while the remaining 36 received no serum 14 of the latter died (40 per cent), in other words nearly twice as many

HUSTED (1941) reports 151 cases of appendicitis from the 1st Department of the Kommunehospital, Copenhagen, among which all the severe cases were treated with serum The mortality of the 151 cases proved to be 5.3, and of the severe cases 23 He recommends serum therapy + chemotherapy at appendicitis-peritonitis HUSTED reports a fatal case of anaphylactic shock in connection with intravenous serum injection

HUSTFELDT & GILG (1943) have a material of 221 cases, of which all the severe cases were treated by chemotherapy — not by serum therapy The material comprises 45 severe cases with 5 deaths, the mortality being thus 11 per cent Under the severe cases the authors do not include 4 cases of appendicitis without peritonitis and without purulent and malodorous exudate at the operation, though chemotherapy had to be given also in these cases, and 2 of the patients died

Chief characteristics of the spleen	Chief characteristics of the bone marrow	Miscellaneous remarks
Marked fibrosis Reticular hyperplasia Marked myeloid transformation of pulp (My, NR and many Mlgk) Follicles reduced but still visible	Not noted	
2,000 g Total myeloid transformation Traces of follicles visible Reticular hyperplasia Numerous foci of NR and scattered Mlgk	Fat marrow (rib and femur) No details given	Progressive enlargement of the liver after the operation Liver biopsy Scattered Mlgk and NR at the operation Autopsy Maximal myeloid infiltration in the liver
600 g "Stalking myeloid metaplasia"	No details given	"Aleukemic myelosis with infiltrations in all organs"
Myeloid infiltration No details given	Not noted	
1,680 g Myeloid metaplasia of pulp with many eosinophils, NR and Mlgk Follicles reduced, but still present	Not noted	
2,200 g Myeloid transformation of pulp with many NR and some Mlgk Reticular hyperplasia Follicles reduced, but present	Biopsy Strongly hyperactive marrow Many immature Mlgk In some places marked fibrosis	
7 000 g Myeloid metaplasia with dominating erythropoiesis In two large areas many My and Mlgk Follicles preserved Some fibrosis	"Decidedly hypoplastic" and "quite cellular" areas alternated (femur)	Scattered hematopoietic foci (including Mlgk) in liver and lymph nodes
1,240 g Follicles largely well preserved Diffuse fibrosis Scattered foci of myelopoiesis and erythropoiesis and many Mlgk throughout the organ	Hyperplastic marrow with normal composition (ster num, femur, vertebrae)	Icterus index 50 Red cell fragility 0.58—0.30 % NaCl
1,100 g Pronounced myeloid metaplasia and fibrosis	Hyperplastic marrow with normal composition	Moderate myeloid infiltration of the liver
745 g Myeloid metaplasia with erythropoietic foci and many Mlgk Well preserved follicles	Not noted	

In the surgical department of the Viborg Hospital the serum therapy was introduced already by the end of 1930, and as the results at once seemed encouraging, we have not dared give it up again. In previous works from our Department (Ugeskrift for Læger No 35, 1937, and Nordisk Medicin 1940, p 1506) one of us (BARTELS) has reported the results obtained so far of the serum therapy. Now we dispose of 2 decennial periods for comparison, viz 1921—1930 and 1931—1940, the former without and the latter with serum. The results of this comparison will be accounted for in the following. Besides, we have a triennial period, 1941—1943 inclusive, within which all severe cases were treated both with serum and by chemotherapy.

### Nature of the Material

The comparison relates exclusively to operations in the acute stage on cases with absolutely certain pathologico-anatomic changes, these being the only ones treated with serum. Among the operations in the acute stage are also reckoned operations for abscess, even though the appendix was not removed.

We have made a critical review of the case records of the patients suffering from appendicitis within the past 23 years and arranged them in different groups.

**Table I**

*The total number of cases of appendicitis*

		Ptt treated conservat			Tot numb of ptt op on	Entire numb of ptt
		Ac app	App w absc	Chron app		
1921	Number	59	17	6	703	785
—1930	Deaths	2	2	0	51	55
	Percentage				7.25 %	7.01 %
1931	Number	76	25	6	1 067	1 174
—1940	Deaths	3	2	0	28	33
	Percentage				2.62 %	2.81 %
1941	Number	39	6	0	313	358
—1943	Deaths	0	0	0	6	6
	Percentage				1.92 %	1.68 %

All interval operations have been collected in a special group, which is not included, no more than appendectomy per occasionem.

Of late years we have got an ever increasing column in the annual reports termed observation for appendicitis or suspicion of appendicitis. It is only natural that observation of uncertain cases takes place in a hospital. Most of them will subside in the course of a few days, and there may possibly among these be hidden some light cases of appendicitis, but some patients are operated on and a normal appendix is removed. Such wrong diagnoses are naturally left out of account.

The cases of clinically certain appendicitis that we have treated conservatively, either because they were very light or because of the debility of the patients (see *infra*), are not included in the statement either. Within the period of 1921—1930 there were 76 such cases with 4 deaths, and 1931—1940 there were 101 cases with 5 deaths. The cause of death was peritonitis in 3 cases, sepsis and diabetes in 2 cases, pneumonia in 2 cases, and finally there were 2 cases in which the diagnosis had been misjudged, the right diagnosis having not been made till the post-mortem examination. A number of those treated conservatively later underwent an interval operation.

### Classification of the Operations in the Acute Stage.

Table II.

*Appendicitis oper. in the acute stage*

		Ac app	Gangr app	Perf app and periton	App w abscess	Total num of op in the ac stage
1921	Number	181	189	112	8	490
—1930	Deaths	3	7	36	2	48
	Percentage		3.70 %	32.1 %		9.79 %
1931	Number	436	351	107	8	902
—1940	Deaths	6	2	18	2	28
	Percentage		0.57 %	16.8 %		3.10 %
1941	Number	115	114	40	6	275
—1943	Deaths	0	1	4	1	6
	Percentage		0.88 %	10.0 %		2.18 %

The classification is here the same as in previous works from our Department, i. e. the cases are divided into acute appendicitis, gangrenous appendicitis, appendicitis with abscess, perforation, and peritonitis.

We know that this classification, like so many others, may be disputed. However, we have not felt inclined to follow Bauer's classification, because in our view it would then be too much a matter of opinion in which group to place each single case. But there are — as also pointed out by other investigators — two severe pathological changes in the vermiform appendix about which we are not easily mistaken, viz. gangrene and perforation, and it seems to us most natural that we should before all pay regard to this fact at the division of the material into groups.

By *acute appendicitis* we understand cases with more or less excessive redness, swelling, and infiltration of the appendix increasing to phlegmon, which may sometimes extend as far as the cecal wall. Thus this group comprises in reality cases that are not quite homogeneous in a pathologico-anatomic respect. There are found both rather light and more virulent cases, and there may also occur cases of acute appendicitis with diffuse peritonitis, but such cases are reckoned in the group of peritonitis.

By *gangrenous appendicitis* we understand cases with gangrene, even if the gangrene is only found in the mucous membrane and has not passed through the entire wall.

We have used serum at more extensive indications than in most other places, as we have used it not only in all cases of perforation and peritonitis, but also in all gangrenous cases, because we regard the main point to be this that the destructive process, which is probably due to the activity of the anaerobic bacteria, perhaps in connection with other factors, is already in progress, even if it is still only the mucous membrane that is affected. It is not always possible on the outside of the appendix to see how deep the process has penetrated, and these apparently rather harmless gangrenous cases have often enough brought disagreeable surprises later in the course (cf. the work by HUSELDT & GILG quoted above).

The serum applied by us was in all cases the serum against gas gangrene from the Danish Serum Institute (cf. year-book of the Medical Society) together with anticolli serum obtained by immunization of horses with selected coli strains (BRUNING). Generally adults received 20 to 25 ccm gas gangrene serum + 25 ccm coli serum intravenously, never intraperitoneally, by the end of the operation, no matter whether this had been carried out in general anesthesia or spinal anesthesia. In particularly severe cases larger doses were given, contingently just as much intra-

muscularly, and the injection was repeated the first few days after the operation. Children received correspondingly smaller doses.

A drawback to this treatment is the serum sickness sometimes occurring within a week after the operation in the form of exanthema, pruritus, fever, and more rarely joint pains. But the cases appearing in our material were generally light and soon disappeared again.

We have had 2 cases of anaphylactic shock, one comparatively light, the other more severe.

The former occurred in a boy aged 10 with a retrocecal appendicitis. The gangrenous tip of the appendix was hidden in a large retrocolic abscess with ill-smelling pus and burst while being excised. He therefore received a comparatively large dose of serum, 20 + 20 ccm, intravenously, and a few minutes after the injection he got a serum shock, from which he soon recovered, however, by injection of 1 milligram adrenalin and 2 ccm coramine intramuscularly.

The latter case occurred in a 35 year old man with a gangrenous appendicitis and empyema. He received 20 + 20 ccm serum intravenously by the end of the operation (ether anesthesia), and in direct connection with this he felt bad, became cyanotic with a feeble pulse and respiration. It was not till after half an hour's treatment by repeated injections of adrenalin, ephedrine and coramine that he was completely restored.

We were now informed that 16 years previously the patient had been treated for tetanus with repeated intraspinal large serum doses. At the case taking he only stated that he had been treated for wounds of corrosion on the legs (calcium nitrate), but nothing about the tetanus, which had developed 3 weeks later, and which had been the real cause of his admission to hospital, nor anything of the treatment with serum.

These two cases are indicative that ether anesthesia does not always protect against anaphylactic shock, as has been maintained by various writers.

Indications for operation and technique were uniform throughout, as the chief of the Department was the same all the time. All patients with appendicitis were operated on except in cases of abscess, or if the patients were of age, obese, and debile, or if there were complications for instance from heart or lungs, which might contraindicate operative treatment. After the first 48 hours we were inclined to be expectant when the process was

crease in the mortality percentage from 9.7 without serum to 3.1 with serum. A comparison can only be drawn on the basis of the severe cases alone.

Table III.

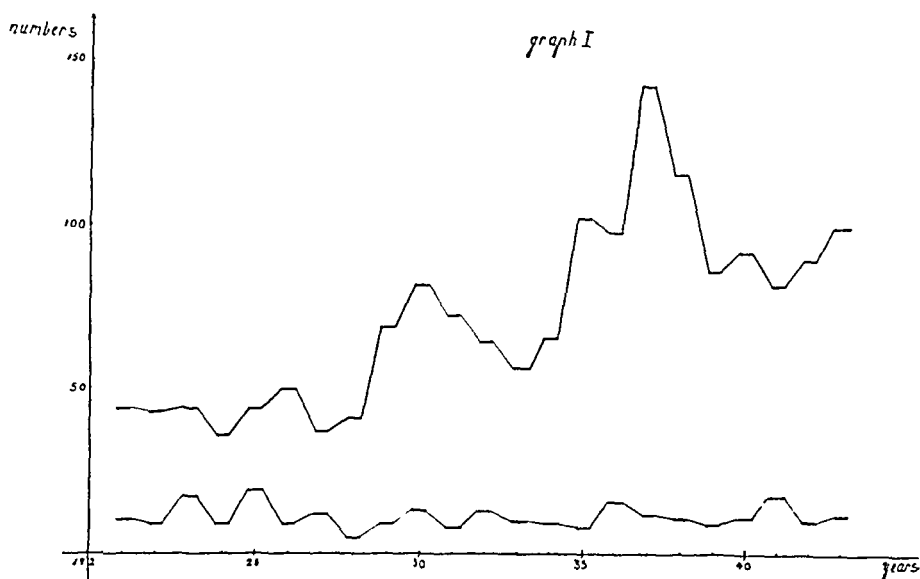
*Cases of appendicitis operated on*

		In the acute stage	Interval			Total numb of ptt op on
			Ac app	App w absc	Chron app	
1921	Number	490	65	12	136	703
—1930	Deaths	48	1	0	2	51
	Percentage	9.7 %				7.25 %
1931	Number	902	65	8	92	1,067
—1940	Deaths	28	0	0	0	28
	Percentage	3.1 %				2.62 %
1941	Number	275	14	1	23	313
—1943	Deaths	6	0	0	0	6
	Percentage	2.18 %				1.92 %

If we look at the cases of peritonitis it appears that the number was nearly the same within the two decennial periods, viz 112 and 107 respectively — lowest in the period in which serum was used. The figures come, however, so close to each other that the slight difference may be disregarded. But within the serum period the number of those dying from peritonitis was but half as great as within the preceding decennium viz 18 against 36, 16.8 and 32.1 per cent respectively.

In order to obtain a graphic expression of the distribution of the severe cases in the course of years we have plotted graph 1, which illustrates the distribution of the cases within the period of 1921—1943 inclusive, thus covering 23 years. The upper curve comprises the total number of cases operated on, 1667 in all, the lower curve only the cases of peritonitis, 259 in all. While the upper curve rises rather steadily all the time reaching a summit at 1938, the lower curve shows that the number of cases of peritonitis, apart from small fluctuations from year to year, remained at about the same level all the time.

This strange fact that the occurrence of the severe cases is rather constant year by year is, however, hardly a peculiarity of our material. BOHMANSSON & NORUP, in their statement in *Nordisk Medicin* 1940 of 3797 cases through 12 years, have arrived



at exactly the same result, and they have plotted a curve that is almost identical with ours

A calculation of the mortality percentage is therefore of but a limited value. It must necessarily differ considerably according to the number of light cases included in the statistical statement, and it serves only to show that the published materials differ so much that they cannot be compared with each other. The perforation percentage on the other hand says more of the nature and the severity of the material.

To make out about the efficiency of a certain treatment — in this case that of the serum therapy — 3 ways may be followed

1) One is to treat only every second patient and compare the results. We have not applied this method, however, because we would not deprive any patient of a chance.

2) The second is to calculate the mortality rate per 100,000 inhabitants for those treated and those not treated with serum. This is, however, impracticable in a county hospital with a field of action that is not well defined from those of the neighbouring hospitals.

3) Finally the third way, the one applied by us, is to compare two long periods, without and with treatment respectively, and in case the treatment — all other conditions alike — has brought the mortality of all groups so far down that the figures can stand the statistical standard error calculation, we may be justified in concluding that the treatment has a value.

e believe to have proved this in the case of the group of peritonitis, within which the number of deaths was reduced by 50 per cent during the serum period as compared with the preceding decennium (18 and 36 respectively), without there being any demonstrable difference in the severity of the cases. The other groups present a corresponding decrease in the mortality. As to the gangrenous cases more than twice as many were operated on within the serum period as within the preceding one. Nevertheless there died only 2 against 7 in the preceding decennium.

The most important criterium must be a comparison between the total numbers of deaths among those operated on within the two periods. The number was within the serum period 28 and within the preceding decennium 48, having thus been reduced by 42 per cent.

That our results of the serum therapy are better than those of most other investigators is probably attributable to the fact that we have not confined ourselves to administering serum only to patients with diffuse peritonitis, but we have used it at far more extensive indications. In Germany the serum has been given the name of "Peritonitiserum." This seems to be an unfortunate name, which has probably contributed to bringing discredit on the treatment, because it must be regarded as doubtful whether serum has any effect whatever on severer forms of diffuse peritonitis. In our opinion the main object of the serum is to be a prophylactic in cases in which the peritoneum is affected without it being visible, thus for instance in cases in which the disease has lasted more than 48 hours, and at gangrenous cases, and comparatively fresh cases of perforation and peritonitis. It is not always possible by the current forms of cultivation to demonstrate an incipient, perhaps anaerobic infection of the peritoneum. Every surgeon has experienced cases in which at the operation he believed to have to do with rather harmless conditions in the peritoneum, but in which in the course of a few days there nevertheless developed an insidious peritonitis, to which the patient succumbed after a week or so. Such cases are seen no longer in our Department.

It seems as if the serum therapy is capable of strengthening an organism whose means of defence threatens to give way, and of helping it to overcome the infection, whether it be due to a specific or an unspecific effect of the serum. In the severest cases of peritonitis, in which the resisting power of the organism is

broken, we can no more than in the severest cases of diphtheria expect any response to serum

Finally we shall only mention that for the last 3 years — 1941—1943 — we have applied a combination of serum therapy and chemotherapy, which seems to give better results than serum therapy alone. The figures are, however, still but comparatively small, viz 275 cases treated by operation, among which 40 with peritonitis, 4 of the latter died, which corresponds to a mortality of 10 per cent of the peritonitis cases. The total mortality was 2.1 per cent.

Coincidentally with the serum therapy we have administered a sulfathiazol solution by subcutaneous infusion according to a method described by assistant surgeons SVENSTRUP and ODDSON, previous assistants to the Viborg Hospital, (1942). The solution contained previously 8 and now 7 grams sulfathiazol per litre and was given like an ordinary saline solution immediately on the operation in a dose adapted to the patient's weight and age, a somewhat smaller dose to females than to males. The following days similar "shocks" were given, contingently in decreasing doses, until the patients were able to take the tablets per os. We want to call attention to this method, from which we have obtained favourable results on peritonitis patients who on account of nausea had difficulty in taking the medicine by the mouth, and who needed fluid.

Within the last few years of the serum period the examination of plasma chlorides, bicarbonate, and serum protein was made in a number of cases, but the examination was not sufficiently systematic to play any considerable part for the results.

If we may at all conclude anything from so small figures, it might seem as if the chemotherapy is a valuable supporting and supplementary factor to the serum therapy. While serum contains antitoxins against the anaerobic bacilli and the colibacilli, sulfathiazol affects the aerobic strains occurring in the peritoneum when the appendix bursts, even the streptococci, against which the serum contains no component.

### Summary.

1) For the elucidation of the effect of serum therapy a comparison is drawn between the operations for appendicitis in the acute stage within 2 decennial periods, one without, the other with

serum therapy, but with the treatment otherwise conducted on the same principles. Within the former period without serum there were 490 operations with 48 deaths, within the latter with serum 902 operations with 28 deaths. Thus the number of deaths decreased in the serum period by 42 per cent.

2) It is demonstrated that the number of cases of peritonitis was nearly the same within the two periods, and that a curve indicating the occurrence of peritonitis through 23 years proves to have an almost horizontal direction with but small fluctuations from year to year. Accordingly differences in the severity of the cases cannot possibly have played any part for the decrease in the mortality within the serum period.

3) The serum is not only a "Peritonitiss Serum". It should be administered in sufficient doses not only after operations for appendicular peritonitis, but also as a prophylactic in gangrenous cases, because nobody knows to what extent the wall is permeable to bacteria, and besides after operation in cases in which the disease is of more than 48 hours' duration, in order to check a contingent latent infection of the peritoneum.

### Zusammenfassung

1) Um die Wirkung der Serumbehandlung zu beleuchten wird ein Vergleich zwischen à chaud Operationen der Wurmfortsatz-Entzündung in 2 zehnjährigen Perioden angestellt, beziehungsweise ohne und mit Serum, wo die Behandlung ubrigens nach denselben Prinzipien geleitet worden ist. In der ersten Periode ohne Serum sind von 490 Operationen 48 todlich verlaufen, in der letzten Periode hatten von 902 Operationen 28 einen todlichen Ausfall. Die Anzahl der Todesfalle fiel mit 42 %.

2) Es wird nachgewiesen, dass die Anzahl der Peritonitisfalle in beiden Perioden eingermassen gleich gewesen ist, und dass man eine Kurve über das Vorkommen der Peritonitisfalle durch 23 Jahre mit einem fast waagerechten Verlauf zeichnen kann, mit nur kleinen Schwankungen von Jahr zu Jahr. Unterschiede in der Schwere der Falle können deshalb für den Rückgang der Mortalität in der Serumperiode keine Rolle spielen.

3) Serum ist nicht nur ein "Peritonitiss Serum". Man muss es in hinlanglich grossen Dosen eingeben, nicht nur nach Operationen der appendicularen Peritonitis, sondern auch prophylaktisch in gangranösen Fällen, weil niemand wissen kann, in welchen

Ausmasse die Wand für Bakterien permeabel ist, endlich bei Operationen in Fällen, wo die Krankheit mehr als 48 Stunden gedauert hat, um eine eventuell latente Infektion des Peritoneums zu bekämpfen

### Résumé.

1) Pour éclaircir le résultat du traitement de sérum on fait une comparaison entre les opérations à chaud des appendicites dans deux périodes de dix ans, respectivement avec et sans sérum, où d'ailleurs le traitement a été guidé par les mêmes principes. Dans la première période sans sérum il y avait sur 490 opérations 48 cas de mort, dans la dernière période avec sérum sur 902 opérations 28 aboutirent à la mort. Le nombre des décès tomba dans la période de sérum avec 42 %

2) Il a été établi que le nombre des cas de péritonite a été assez invariable dans les deux périodes, et qu'on peut dresser une courbe presque horizontale sur la fréquence des cas de péritonite pendant un espace de 23 ans, avec de petites variations année par année. C'est pourquoi des différences dans la gravité des cas n'ont aucune importance pour la diminution de la mortalité dans la période de sérum

3) Le sérum n'est pas seulement un sérum de péritonite. Il faut le donner à assez fortes doses, non seulement après les opérations de la péritonite mais aussi prophylactique dans des cas de gangrène, parce que personne ne sait dans quelle mesure la paroi est perméable aux microbes, enfin dans des cas d'opération où la maladie a duré plus de 48 heures pour combattre une infection latente du péritoine

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## Rectal Prolapses in Children

By

OLLE WIKLANDER

The prolapses are, as a rule, classified in three groups, viz, firstly, *prolapsus ani*, indicating a prolapse of the part of the rectum next to the anus — usually considered to involve a slipping forward of the mucous membrane only —, secondly, *prolapsus ani et recti*, where the part next to the anus, as well as the parts situated higher up, prolapse and, finally, the group termed *prolapsus recti*, where the anal part retains its normal position while higher parts fall out of place. Prolapsus ani et recti is distinguishable from prolapsus recti by the fact that, in the latter event, a finger can be inserted between the anal ring and round the part which has slipped forward up to the edge of the inversion, while in the case of prolapsus ani et recti no such pocket formation takes place. It has, now and then, been found difficult to adhere to this classification since the opportunity of a personal inspection of the prolapse does not always present itself. A prolapse may, of course, be provoked for the purpose of differential diagnosis. However, this is, doubtless, only necessary on rare occasions. Furthermore, the classification lacks interest also from the point of view of the therapeutical procedure, as long as the different forms do not indicate different methods of treatment. It has, therefore, been rejected in this connection. All the cases have been recorded as prolapsus recti which is, moreover, considered to be the most common form.

Rectal prolapses are much more frequent in children than in adults. WEBER found, in his material, that almost 90 per cent

concerned children The prolapse generally makes its first appearance during the second year of life, and the great majority of cases occur during the second to the fourth year of life The age distribution of the 48 cases treated at K L B, during the years 1932—1942, may be illustrated as follows

Age	Number of Cases
0—1 years	1
1—2    »	27
2—3    »	7
3—4    »	9
4—5    »	0
5—6    »	1

27 cases, i e more than half the total number, have occurred during the second year of life and not less than 43 out of 48 cases during the second to the fourth year of life The oldest child was 5 years and 2 months of age A prolapse is very rare in children in the school age It is, likewise, comparatively unusual during the first year of life, when it manifests itself, as a rule in connection with some more severe state of disease with a strong decrease of turgor and tonus

Data vary as regards the sex distribution KOCH found an equal number of boys and girls among 26 cases, while MOKS found 2 girls and 10 boys in a material comprising 12 cases The present material of 48 cases contained 31 boys, i e almost  $\frac{2}{3}$  It may, perhaps, be of some interest to note that the sex distribution is approximately the same with regard to intussusception, pylorostenosis and megacolon

The accumulation of prolapses between the second and fourth year of life shows that certain predisposing factors must occur during this period They have been looked for, inter alia, in the special *anatomical conditions* of the child Thus, the sacrum still, to a great extent, lacks its bend, and the coccygis has a more vertical course which results in a more straight course also of the rectum Hereby, the abdominal press is transmitted more directly in the direction of the intestine towards the anal opening while in adults, where a fairly marked bend has occurred, the abdominal press reaches a region behind the anal opening with a bone foundation as support WALDEYER and LUDLOFF draw attention to the greatly developed excavatio rectovesicalis (the Douglas pouch) which extends to the pelvic bottom at the

time of birth and only attains its definite position during the third year of life. This theory is, to a certain degree, borne out by the finding of a lowered Douglas pouch in adult prolapses.

Even the serosa-covered part of the rectum reaches further down in children. In this way, a prolongation of the mesorectum takes place with accompanying increased movability. JEANEUL is of the opinion that this prolongation of the colon pelvicum and its suspension apparatus, as well as a decrease in their firmness, constitute the main cause of the appearance of a prolapse. DRACHTER and GOSSMAN attribute most importance to the comparatively weak development of the pelvic bottom, offering as evidence the fact that the most severe cases occur at spina bifida cystica and bladder ectopy, since the pelvic bottom is, usually, pronouncedly relaxed.

LOCKHART MUMMERY and, later, RAINEY look for an explanation of the occurrence of a prolapse in the early training of the child to sit in an *incorrect position at defecation*. The straight course of the rectum is accentuated by the upright position, while the squatting position strains the fascia pelvis and causes the coccygis to be drawn forwards. A prolapse is said not to occur among primitive peoples who have early been taught to sit in a squatting position.

KLEINSCHMIDT ascribes the greatest significance to *innervation disturbances* in the intestine. He indicates the neuropathic constitution as a mutual characteristic. Besides the prolapse, hyper-irritability, uneasiness, fear, fidgetiness, disturbed sleep, habitual vomiting, abdominal pains, enures, incontinentia alvi, respiratory spasms, etc., are to be noted. On the other hand, other authors maintain, no doubt correctly, that the neuropathic traits form no cause of the prolapse but are a result of it. It is, perhaps, still more probable that both the prolapse and the neuropathy are the consequences of bad home conditions.

The contributory and causative factors are as follows: diarrhoea, obstipation, underfeeding, whooping-cough, adenoids, cystitis, urinary calculus, phimosis, rectal polypi and helminths. 45 of the 48 cases treated at K. L. B. have been available for after-examination. However, owing to the fairly long time interval and the partially incomplete case records, reliable data in this respect have been obtainable in only 35 cases. Obstipation occurred in 20 cases, diarrhoea in 6, sluggish bowels and diarrhoea alternately in 1, whooping-cough in 6, and unknown cause in

another 6. In one case the prolapse set in after the consumption of masses of green apples, and on a later occasion this gave rise to recidivism. Thus, obstipation plays a fairly prominent part. However this is not surprising since obstipated children have to strain more and also spend longer time on the stool which is considered by the majority of authors to contribute considerably to the appearance of a prolapse. Nevertheless, it is not unlikely that the number of obstipated cases is even greater. Information regarding the evacuations being frequently most uncertain particularly concerning somewhat older children. It is in fact, quite usual to find the ampulla filled with hard scybala notwithstanding the assurances of the parents that the child had had normal and daily evacuations.

*Bad social conditions* have not gained the attention they no doubt, deserve. GOHRBANDI—KARGIR—BIRGMANN in their textbook on child surgery state ‘— — — in performing conservative treatment such pronounced difficulties are in many instances, met with, owing to unfavourable home conditions as to render operation recommendable for social reasons. Also KLINSCHMIDT enters upon this subject declaring with regard to a suggestion of conservative treatment that ‘the carrying out of this treatment requires a certain care and dexterity which cannot be looked for in all quarters. Not less than 10 of the 18 children treated at K. L. B. were born out of wedlock and were admitted from Children's Homes, 6 having spent their time at a daynursery. It is an indisputable fact that the chamber-pot is a sure parking place for these children during long periods of the day. The control of the child's evacuation will also be inadequate, since several persons, without any close contact with one another, are daily in charge of the children. 6 children have been looked after by a domestic servant when the mothers have had work outside the home. The Children's Welfare Board has had to intervene in 2 cases owing to neglect. 21 cases have been reported to have been nursed all the time by the mothers. No investigation has been performable of the social conditions of these latter children. However, the following may serve as an example of the hygienic standard in one of these homes. When no improvement occurred after the operation, the mother visited a female quack who prescribed some kind of ointment for external as well as internal use. The child was then allowed to excrete in the trousers, as

the mother, naturally, did not then notice the prolapse quite as often. Thus, the children's treatment has been unsatisfactory in not less than 24 of the 15 cases, and even in the majority of the remaining 21 the home conditions have definitely been suspected of neglect. It may also be noted that no single case has been treated in a private ward which generally contains a more well-to-do clientele from a social point of view. *Accordingly, there seems to be no doubt whatever that children with rectal prolapses come, to a greater extent, from a less fortunate stratum of society.*

The majority of authors state that rectal polypi may give rise to prolapses. This probably concerns, in the first place, a slight lowering of the mucous membrane. No polypus has been ascertainable in any of the cases examined in this material, while 76 cases of rectal polypi have been treated simultaneously without any signs of prolapse.

Diseases, which cause a weakening of the physical strength and loss of weight, are considered to favour the occurrence of a prolapse. DRACHTER and GOSSMANN found a considerable increase during the war years of 1917—1918, attributing it to insufficient diet. The weight of the after-examined children in the present material has been compared with the mean weight according to the standard table of B. B., G. D. and A. L. In 14 instances the weight exceeds or equals the mean weight, in 27 cases it falls below it, in another 4 it equals or falls below the maximum variation range, i. e. close on or within the limits of a distinctly pathological state. One of the 4 latter cases concerned a boy of 1½ year of age. His weight was 5.21 Kg. The child was greatly affected with markedly reduced, flaccid flesh and a bulging perineum. Another case concerned a girl of 3 months with a birth weight of 3.010. Her weight at admission was 2.700. General condition was very bad and she was fairly thin, with flaccid flesh. The pelvic bottom was altogether slack. The treatment gave no results. Both the children died fairly soon afterwards. In these instances, the prolapse constituted an insignificant although troublesome complication. The third case concerned a boy of 2 years and 7 months who weighed 10 Kg. He was otherwise quite healthy. Striping gave permanent recovery. The last case concerned a boy of 2 years and 3 months with a weight of 10.4 Kg. and otherwise in good health. He was discharged as healthy after 3 weeks of conservative treatment. Unfortunately,

the weight has not been registrable in relation to the length of the child, owing to the lack of information in this respect. The figures are, consequently, not quite reliable but may, all the same, justify the drawing of certain conclusions. Thus, a good  $\frac{2}{3}$  of the cases fell below the mean weight, 1 of them approximating or falling within a pathological state. Accordingly, a prolapse is more common among thin children than among well-nourished ones. Still, it is not advisable to assume any definite causative connection since the thinness is, no doubt, in the majority of cases only a manifestation of several unfavourable social factors. On the other hand, a sudden loss of weight with decreased turgor and tonus appear indubitably to be predisposing involving complications with regard to the treatment.

As a rule the symptoms are insignificant. At defecation, a pale red mass comes out of the anus. This usually does not trouble the child and the mother's attention is drawn to it only when the child gets up from the stool. The prolapse is most often reduced spontaneously. Sometimes a little blood will be noticed together with the evacuation. When the prolapse is not reduced and the sphincteral effect is good stasis with edematous formation appear, as well as cyanosis and slight bleedings in the mucous membrane. In neglected cases, ulcerations, gangrene and even peritonitis are said to be possible. The prolapse may either be noticeable once or twice, or at each defecation, or several times daily in more severe cases when the sphincter is slack, without having any particular recourse to abdominal press.

Diagnosis is very easy and may, generally, be established by the parents. Confusion with an invagination prolapsed through the anus may be avoided by the insertion of a finger between the anus and the prolapsed intestinal part. At invagination, no inversion edge will then be felt. However this procedure will probably only be necessary on very rare occasions, since the anamnesis should eliminate all possibility of confusion. Sometimes the parents may take rectal polyp for a prolapse and may thus give misleading informations. Among the 76 cases treated at K. L. B. for rectal polyp, 5 applied at the hospital owing to prolapse of the rectum. 6 owing to a bluish-red protuberance, the size of a plum, which projected out of the anus at defecation. One of these patients was admitted to the surgical department as a case of prolapse. This was, in fact, recorded by the nurse on the curve on one of the first days. Merely a more careful

registration of the anamnesis would suffice to eliminate a similar mistake. Bleeding is the principal symptom with regard to polyp. It occurred in not less than 74 cases. In 49 instances, bleeding was the only symptom, and the remaining 25 revealed, in addition to bleeding, the prolapse of formations up to the size of a plum, which are described as prolapse of the rectum, brownish glands, nodes, lumps, tumours, or warts. In doubtful cases digital exploration and, as a last recourse, rectoscopy will decide the matter.

Confusion with haemorrhoids, which are very rare at this age, or with naevi, localized to the transition between the anal mucous membrane and the skin, need hardly be feared.

In the first place, treatment must be concentrated on reducing the prolapse in cases where it has not done so spontaneously, or when the parents have been unable to put it back. Small children may suitably be placed across the knee, while the prolapse is reduced, in bigger children in a knee and elbow position. When a more pronounced edema is noted, this may easily be lessened by means of massage and slight compression. The prolapse should invariably be reduced from the top. Should the child be screaming, reduction may be attempted during inspiration. Narcosis may, possibly, have to be administered. Many different methods have been tested in order to keep the prolapse back, viz., plaster, the introduction of a thick drain tube in the rectum, tamponade, various *pelotte* contrivances etc. At K. L. B. recumbency is regarded as sufficient. The causative factors are eliminated and the diet is specified. When the obstipation is very severe, a small laxative is administered, such as paraffin, fig syrup, etc. At first, the child is allowed to defecate in a supine position. After a week or more, an attempt is made to let the child sit on the chamber-vessel while the legs are permitted to hang freely in order to prevent full use of the abdominal press. Accordingly, the vessel may suitably be placed on a chair or on a table. This arrangement is good also from the point of view of the necessity then of watching the child during the whole procedure, the risk of its being left there for hours on end being all but done away with. Data regarding the duration of the conservative treatment vary from 14 days up to half a year.

In milder cases, a fortnight will probably be sufficient, particularly when the home conditions are satisfactory. Still, as a rule, an extension of the period of treatment to 3 weeks or a month

is desirable, owing to the fact that these children stand in good need of the diet and hygienic conditions bestowed at the hospital. Also in the most severe cases with deteriorated general condition and loose, bulging pelvic bottom, where surgical intervention was taken into consideration from the very start, conservative treatment for a brief space of time would, no doubt, not be amiss in order to improve the general condition of the child since the prospects of good results after an operation would also be increased in this way.

Few diseased conditions have given rise to an equally great number of surgical methods. This clearly serves to prove the inadequacy of the various procedures. However, the fact that the majority give good and on the whole, compatible results is no doubt, due to the tendency of this disease towards spontaneous recovery. A short account will now be given of the most common methods in this connection.

**THIERSCH's method.** A silver thread is guided by a strongly bent needle subcutaneously round the anus through a small incision in front of and behind it. The silver thread is then tied across a forefinger or a little finger which has been inserted into the anus. The end of the thread is folded down and the wounds are sutured. A finger in the rectum will serve to control that the mucous membrane is left uninjured. In the first place, the method is devised as a purely mechanical means of counteracting a prolapse, but it will also cause a more intimate connection between the rectum and the surroundings by scar formation in the periproctal tissue. Instead of silver thread, also silk has been employed (BITTNER, WINKLER). **KIRSCHNER** uses fascies strips.

The French, who consider the main cause of the prolapse to be a prolongation and slackening of the suspension apparatus of the rectum, have introduced the so-called suspension methods: *rectopexy* and *colopexy* with **VERNEUIL** and **JEANNEL** as the respective originators. A method which has come to use a great deal particularly in Sweden is the one made known by **EKRHORN** in 1909.

On one side of the inferior part of the sacrum an aimed needle is stuck through the skin and the soft parts into the rectum. The point of the needle is then driven out through the anus, being guided by a finger inserted into the anus. A thick silk thread is introduced into the armature and the needle pulled back. Then, the other end of the thread is pulled up to the opposite

side of the sacrum in a similar manner and tied across the skin. The thread is, as a rule, allowed to remain for 12 days. In this way, the bend of the rectum may be increased and the effect of the abdominal press decreased as well as causing a fixation of the posterior rectal wall against the sacrum by means of scar formation from the infected incision canals.

Colopexy has also been performed on children. WIEBER reports, in 1923, 51 cases, 31 of which had been after-examined. Recidivism occurred in 2 instances. The sigmoideum coil was drawn up forcibly and adjusted to the anterior abdominal wall. In one case the healing process was protracted owing to an abscess in the abdominal wall. The healing was primary in the remaining cases.

In 1905, HOLMANN published a method of *plastic surgery of the pelvic bottom*, by means of which this was prolonged forwards and the rectum obtained a better support. An H-shaped incision was applied to the posterior part of the anus and the rectum was fixed for 4—5 cm. by means of blunt instruments. Both the edges of the wound were grasped by clasps and pulled forwards and backwards, respectively, so as to form a funnel-shaped cavity, sutured transversely stage by stage with catgut.

*Resection methods*, according to MIKULITZ or REHN-DELOPME, hardly appear to have been made use of on children. In the latter case, only the mucous membrane is extirpated and the part of the rectum which has been prepared free from the mucous membrane is sutured in transverse folds so as to cause a sphincter-like formation.

*Cauterization*, or 'stripping', as termed at K. L. B., is, perhaps, the oldest and most simple method. The abdomen of the child is properly emptied prior to operation. The child is placed in a gynecological position. During the excitatory stage, the prolapse now and then appears but, as a rule, the anus must be slightly widened. The prolapse may then be pulled forward and wiped clean. About 6 longitudinal streaks are seared by means of a diathermic bulb in the mucous membrane along the prolapse, up to and particularly at the transition to the skin. Then, the prolapse is reduced. The child is kept in bed for a week and is set on a loosening diet. A connective tissue proliferation is obtained by means of stripping with gradual scar formation which serves to fix the rectum more solidly to its adjacent parts. On

account of the fairly long time taken by this method a slight prolapse is not an uncommon occurrence during the period just after the operation

*Injections* in the periproctal tissue of various substances, such as alcohol sodium salicylate milk and above all, paraffin, have been used to a great extent apparently, with good results. However this is said to be rather a painful method and not by any means without risks.

During the years 1932—1942, 18 cases of rectal prolapse have been treated at K. L. B. 14 cases have been subjected only to conservative treatment. The duration of the treatment has varied between 2 and 40 days amounting to, on an average approximately 10 days. The short period of treatment of merely 2 days is due to the fact that the child in question was in such a bad state that it was considered best, in the first place to remit it to the medical department where it died shortly afterwards of an internal affection. It should in fact actually not have been included in this connection. 7 of the 13 remaining cases recovered permanently one case having a prolapse during the first week after its home-coming a second case having daily prolapses during the first week but not afterwards, and a third case disclosing a prolapse 2 months after the discharge. One child suffered from repeated prolapses soon after the home-coming and 9 months later. Accordingly it was re-admitted and subjected to conservative treatment for 13 days. The prolapse never re-appeared after that. In 2 cases no improvement was ascertained at a control examination half a year and one year, respectively, after the stay at the hospital. The parents had neglected to attend with their children after the discharge.

Thus, recovery has set in 2 months after the discharge in 10 cases, 1 case healing after a short period of treatment 9 months after the first stay at the hospital and 2 cases having failed to improve. These results must indeed be regarded as very encouraging especially when the rather short treatment is taken into account — an average of 10 days — as against the 22 days after operation according to THILRSCH approximately 19 days according to EKRHORN, and 21 days with the stripping method. It will, of course be readily acknowledged that the cases subjected to conservative treatment belong to the milder ones. However even fairly serious cases occurred with prolapses extending up to 7 cm. in length and of several months duration.

THIERSCH'S method has been employed in 5 cases, the last time in the year 1936. 4 of them had a period of treatment equaling 18—27 days, i. e. an average of 22 days. The fifth case had been operated on 8 days earlier according to EKEHORN'S method. Consequently, the duration of the treatment could not, in this instance, be included in the calculations. All the cases were submitted to operation on the day or days following the admission to the hospital. No reaction occurred in 2 cases after the surgical intervention. A rise in the temperature was ascertained in one case up to a maximum of  $40^{\circ}\text{C}$  but the child was afebrile on the fifth day. In another case, an infection was noted round the thread after a week. When the thread had been extracted on the tenth day, the local symptoms rapidly subsided. A month after operation, one of the children was subjected to painful evacuations and had to be admitted to the hospital. It was treated there for a month. An abscess had formed round the ring just inside the anus. When the ring was extracted, the local symptoms gradually abated and no further intervention was necessary.

3 cases showed primary healing. 2 of them, however, had been operated on previously according to EKEHORN'S method. In one case, the prolapse was noticed on one occasion during the first month after the arrival at its home, but was never repeated. In another instance, the thread gave way as early as on the day after operation. The child was much affected, but operation was carried out notwithstanding owing to the continual appearance of a 10 cm. long prolapse which bled slightly. This child died of its original disease 17 days after the surgical intervention. Accordingly, its death is not attributable to the operation. It is true that a rise of up to  $40^{\circ}\text{C}$  occurred in the temperature on the following day. However, this disappeared again on the next day. One case was a failure. The very bad general condition of this child, with a completely slack and bulging pelvic bottom, renders a comparison with the other cases inequitable since they cannot be looked upon as nearly as complicated. With the exclusion of this case, then the percentage of recovery equalled 100.

EKEHORN'S method has been employed in 13 cases between the years 1932 and 1936. Two of these cases have later been operated on according to THIERSCH and are included among them. During the years 1932—1935, attempts were made, in

the first place, to use conservative treatment. The children were kept in bed with the usual diet for 3—13 days prior to operation, an average of  $6\frac{1}{2}$  days. In 1936 on the other hand, operation was carried out on the days immediately after the admission and the average duration of the treatment before the surgical intervention was  $2\frac{1}{2}$  days. In this way, the average time of the treatment was abbreviated, being in the former case 22 days and in the latter 16.

No reaction after operation was noticed in 3 cases. In another 3 cases a rise in the temperature to over  $39^{\circ}\text{C}$  was observed and in 5 cases between  $38^{\circ}$  and  $39^{\circ}$ . The general condition of the children was not affected in any single case and all were afebrile on the fifth day at the latest. In one case, the thread had to be extracted as early as on the fourth day owing to an infection, but the general condition was never affected and the patient was free from temperature on the next day. One child disclosed painful evacuations and fits of spasms in the sphincter for 3 months. A control examination gave only hypertonia of the sphincter. The child was obstipated and the troubles disappeared rapidly when the diet had been regulated. Thus, only in one case did a more pronounced local reaction occur which quickly subsided after premature removal of the suture. This child was discharged as permanently recovered.

In 8 instances the prolapse has not manifested itself after operation. One child had one or two prolapses immediately after its home-coming, another had a few prolapses 1 and 4 months after the surgical intervention, and yet another two cases showed no improvement. In one case, attempts at coming into contact with the mother have not been successful. Thus, with the exclusion of this particular case, 8 cases out of 12 had permanent primary healing. These results resemble fairly exactly those published by GUSTAV FRÉREN regarding the 26 cases described by him in 1925. Recidivism has occurred in 2 cases soon after the home-coming, but complete recovery has set in after 1 month, at the latest. 10 cases out of 12 have, accordingly, healed 1 month after operation. No improvement was obtained in 2 cases. It has perhaps, not been altogether without significance that these patients have been operated on almost immediately after the admission to the hospital and that the period of treatment was only 14 days in one of the cases, i. e. the shortest duration of them all. The other case was operated on, at the same occasion,

according to THILRSCH's method, which is the reason for the exclusion of the period of treatment from the calculations.

Ever since 1938, *stripping* has been the main procedure, equalizing a total number of 19 cases. Conservative treatment has first been attempted for a varying length of time, i. e. from 3—21 days or, on an average, 11 days. The period of treatment has varied between 9 and 42 days, averaging 21 days. 9 cases were subjected to altogether conservative treatment during the same time, i. e. approximately  $\frac{1}{3}$  of the cases.

No reaction whatever occurred locally or generally in 8 cases after the surgical intervention. In one case a rise in the temperature exceeding  $40^{\circ}\text{C}$  was ascertained, in 4 cases between  $39^{\circ}$  and  $40^{\circ}$ , in another 4 between  $38^{\circ}$  and  $39^{\circ}$ , and in 2 falling below  $38^{\circ}\text{C}$ . The general condition was unaffected in all the cases and the patients were afebrile again on the second or third day after operation, with the exception of one case where this set in on the fifth day. No observation was made at the department of any painful evacuations after operation, but in 4 cases the mothers declare that the evacuations had been rather painful during the first fortnight after the return home. Accordingly, anesthetic stool pills were administered in one case. A polyclinic control examination 2 months later in one case revealed a circular rigidity of the mucous membrane about 3 cm. above the anus, although a finger could be inserted without difficulty. It was easily dilated by the finger and 3 months later the mucous membrane was soft and movable without any signs of stenosis. The child had daily normal evacuations all the time without any troubles. In another case, a control examination 3 weeks later revealed a constriction of the rectum to a ring 3—4 cm. up which let through a forefinger with great ease. No fibrous occurrences were palpable. It was dilated to Hegar 16 without difficulty on 3 occasions and felt considerably softer a month later. All the time, the child had daily normal evacuations without any troubles. A control examination 2 years later gave no pathological finding per rectum.

In 9 cases the prolapse has not been visible until after the operation. However, 2 of these cases have not been available for after-examination. In 4 instances the prolapse manifested itself on one or more occasions immediately after the homecoming, in one of these cases during 4 months in connection with whooping-cough. In 3 cases the prolapse was noticed for a brief time one, two and three years, respectively, after the surg-

real intervention, in 2 of them in connection with gastroenteritis in one of them after the consumption of masses of green apples which also was the cause of the original prolapse. In 2 cases a prolapse will still appear on rare occasions after 1 month and 1½ year, respectively. Both these instances suffer from sluggish bowels and belong to the Children's Homes category. However, they have now been placed in foster-homes. One case was discharged as healed, but was subjected to repeated prolapses again soon after the home-coming. It was, accordingly, re-admitted 5 months later and given conservative treatment for 8 days during which a prolapse was noticed on the day of arrival though not repeated. The child was control-examined 1 year after the last stay at the hospital.

Thus, 9 cases, 2 of which have not been available for control examination, have recovered primarily. In 1 of them recidivism occurred after the home-coming, but all recovered after 4 months. Recidivism was ascertained in 3 cases 1—3 years after the operations in connection with enteritis and in one case, fairly soon after the home-coming. However, complete recovery was obtained 5 months later after 8 days of conservative treatment. Complete recovery failed to occur in 2 cases which nevertheless revealed considerable improvement. The time of control equals, in one instance, only 4 months.

Disregarding 3 cases of late recidivism within a brief space of time, 17 cases out of 19 have been found to have healed 5 months after operation. No complete failure has been registered. Nevertheless, prolapses still occur now and then in 2 cases 4 months and 1½ year after the surgical intervention. It is possible that the patients' unfavourable social conditions have played a part as a contributory cause of this partial failure.

As already mentioned, rectal prolapses in children are a very benign affliction causing but slight trouble to the patient, if any, as long as the prolapse is reduced of its own accord as often occurs. In only 2 cases out of 48, reduction of the prolapse has been necessary, both times easily without narcosis. In addition, the prolapse shows a very marked tendency towards spontaneous healing. This increases as the child grows older and renders a prolapse after the age of 6 a rare occurrence. *Therefore, treatment should, in the first place, be conservative.* The fact that operation is, all the same, resorted to, to such a great extent, is, no doubt,

due to the conception that conservative methods are more time-consuming and complicated and that the after-treatment, which is of particular importance in such instances, is unsatisfactory owing to social reasons. If the duration of the treatment of cases subjected to conservative measures were, as a rule, equal in length to that of operated cases, a considerably smaller number would require surgical intervention than usually happens. CZERNY and KELLER point out that they have not had recourse to surgical aid in any single case. At K. L. B., conservative treatment has, in fact, been increasingly adopted during the last years. Thus, among the 14 cases described here, not less than 5 have been treated during 1942. Attempts have, in the first place, been made with conservative methods in almost all the cases. However, the time at disposal has, on an average, been too short to permit of any more noticeable results. Moreover, in 9 of the cases subjected to stripping, the surgeon has without doubt been in too great a hurry. One case was operated on the twelfth day without the appearance of the prolapse, 2 cases on the twelfth day when the prolapse had been noted on two occasions during the first week. In 4 other cases operation was performed on the seventh, eighth, ninth and eleventh day after the appearance of a prolapse one, two, one and four times, respectively. These children have been given their clothes as early as on the fourth day. Finally, operation was carried out in 2 cases on the fourteenth and eighteenth day after the appearance of a prolapse two and three times, respectively. Conservative treatment would, no doubt, have offered equally good results in these instances without any noteworthy prolongation of the time of treatment. It would probably be unsuitable to attempt to set up a scheme for the time required for a conservative treatment, since it must vary according to the degree of severity of the prolapse, the general condition of the child, and the social prerequisites. However, treatment for at least 3 weeks to a month would be desirable with regard to these children also from a general medical point of view.

Surgical intervention is indicated in cases where the conservative method fails to give results within a reasonable amount of time and the risk of recidivism after the home-coming is particularly big. As mentioned above, there are many methods to choose among. However, no very great mistake is made if the smallest and most simple intervention is selected. Three methods have been employed at K. L. B., viz., that of THIERSCH, that of EKE-

HORN, and *stripping* THIERSCH's method is widely in use in Germany and is, probably, there considered to be the best although criticisms have not been lacking.

Thus, WEBER states that not less than 35 cases out of 88, which have been treated with a ring, were subjected to serious wound complications, inter alia, periproctie inflammations with fistulas and cicatricial stenosis. The results are given as 85—90 per cent healing. THIERSCH's method, accordingly, does not offer better results than those obtained by EKEHORN, or by *stripping*, but the risks of more or less serious complications are considerably greater. This is proved also by the few cases from K. L. B. Therefore, the method should not be employed when the troubles prior to operation are insignificant or non-existent and when good results are obtainable by less risky methods.

EKEHORN's method is probably the most usual one in Sweden but has also been employed, inter alia, in Germany and Denmark. PETRÉN reports 58 cases subjected to after-examination by him. EKEHORN and MOLLER, all healing primarily or shortly after the operation. 15 of these cases, which were after-examined by EKEHORN, had been submitted to surgical intervention more than 5 years earlier. An after-examination of such a comparatively lenient affliction after such a long time will, no doubt, produce rather uncertain data and, perhaps in this case, misleading ones, since at the age concerned prolapses are hardly to be expected. Thus, contrary to the majority of other after-examinations, the value of the examination is actually diminished with an increase in the lapse of time after the treatment. However, the results obtained by EKEHORN's method are, undoubtedly, quite as good as those gained by other methods. The risk of complications appears to be fairly slight, strangely enough, and is, as a rule, restricted to rather insignificant suppuration from the wound canals, more pronounced local reactions occurring only in exceptional cases. Still, this method is not very satisfactory owing to the fact that a source of infection in the periproctal tissue is all the same, formed by the connection between the skin and the rectum. Moreover, it is more difficult from a technical point of view than *stripping*, a procedure which has replaced EKEHORN's method at K. L. B. during the last years.

*Stripping* is an extremely simple surgical method. It gives rise to no actual troubles with the exception of a fairly moderate rise in the temperature during the first days after the operation.

The principal objection has been the risk of a stricture BAUER pronounced the method to be antiquated as early as in the year 1914 owing to this risk. This is, however, undoubtedly due to an erroneous execution of the method, the prolapse having been seared in its entire surface and, at times, even into the muscularis. Several American authors (KELLEY, BOLLING) recommend stripping above all other methods, but advise caution against searing the whole surface of the prolapse. When only longitudinal streaks are seared with a distance of 2—3 cm. between them, no risk of a stricture occurs. Out of the 19 after-examined cases, only 2 disclosed slight stenosis which disappeared after a short time and did not cause the children any trouble at all.

*The results gained by stripping are as good as those obtained by other methods. Therefore, it is recommended as the most simple and least dangerous method in cases where a conservative treatment has not been a success.*

### Summary.

18 cases of rectal prolapse treated at the Surgical Department of Kionprinsessan Lovisas Bainsjukhus during the years 1932—1942 have been subjected to after-examination by the present author. Obstipation has been the most common causative and contributory factor, occurring in more than 50 per cent. As a rule, bad social conditions have seldom been noted as a contributory cause. The majority of these children have come from neglected homes and, in more than 50 per cent of the after-examined cases, the treatment has been altogether inadequate.

A prolapse generally causes very slight troubles and the tendency towards spontaneous healing is great, increasing with the age of the child. *Therefore, the treatment should, in the first place, be conservative.* The child is kept in bed, the diet is regulated, attempts are made to improve its general condition, and the child is hindered from using to a full extent the abdominal press at defecation by letting it defecate in a supine position or sitting on the chamber-vessel with the legs hanging freely. Operation is indicated in the cases where there is special reason to fear recidivism after the home-coming or when conservative methods have failed to give results. However, only a restricted number of cases will require surgical intervention if the time of the conservative treatment is prolonged to about a month.

Three different surgical methods have been employed at K L B viz that of THIERSCHE, that of EKEHORN, and *stripping by means of diathermy*. They give approximately uniform results with permanent healing in 85—90 per cent. Only stripping has been used during the last years. When correctly performed, i. e. when 4—6 longitudinal streaks are seared to the whole extent of the prolapse, this method is the most simple and least dangerous, causing hardly any complications. *It is accordingly, recommended as the best method in cases where operation has been regarded as indicated for medical or social reasons.*

### Zusammenfassung

Veif hat 18 Fälle von Mastdampfiolaps nachuntersucht, die in den Jahren 1932—42 in der Chir. Klin. des Kinderkrankenhauses der Kronprinzessin Lovisa in Pflege waren. Als auslösende und beitragende Ursache kam am allerhäufigsten Obstipation vor, und diese war in über 50 % vorhanden. Soziale Misstände haben als beitragende Ursache im allgemeinen wenig Beachtung gefunden. Die Mehrzahl der Kinder mit Mastdampfiolaps hatten weniger gute häusliche Verhältnisse, und bei über 50 % der nachuntersuchten Fälle war die Pflege durchaus unbefriedigend.

Der Prolaps gibt im allgemeinen unbedeutende Beschwerden und die Neigung zur Spontanheilung ist gross, grosser je älter das Kind wird. *Die Behandlung soll deshalb in erster Linie eine konservative sein.* Das Kind wird im Bett gehalten, die Diät geregelt, man versucht den Kräftezustand des Kindes zu heben und zu verhindern, dass es beim Stuhlgang die Bauchpresse in vollem Ausmasse ausnutzt, indem man es in liegender Stellung den Darm entleeren oder mit hangenden Beinen auf dem Topf sitzen lässt. In Fällen, wo man besonders grossen Grund hat, nach der Heimkehr ein Rezidiv zu befürchten, oder wo konservative Methoden versagen, ist die Operation indiziert. Nur eine geringere Zahl von Fällen durfte jedoch einen chirurgischen Eingriff erfordern, wenn die Dauer der konservativen Behandlung auf etwa einen Monat ausgedehnt wird.

Drei verschiedene Operationsmethoden sind im Kinderkrankenhause der Kronprinzessin Lovisa zur Verwendung gekommen, nämlich die Methode nach THIERSCHE, die nach EKEHORN und die *Streifenbrennung mittels Diathermie*. Sie geben ungefähr gleich-

weittige Resultate mit 85—90 % dauernder Heilung. In den letzten Jahren ist nun die Streifenbrennung zur Verwendung gekommen. Wenn sie in der richtigen Weise ausgeführt wird, d. h. wenn in der Ausdehnung des Prolapses 4—6 longitudinale Streifen gebrannt werden, so ist die Methode die ungefährlichste und gibt praktisch keine Komplikationen. *Sie wird deshalb als die beste Methode empfohlen in Fällen, wo eine Operation aus medizinischen oder sozialen Gründen indiziert erscheint.*

### Résumé.

L'auteur a réexaminé 48 cas de prolapsus du rectum qui avaient été soignés à la Division Chirurgicale de l'Hôpital d'Enfants de la Princesse Louise, de 1932 à 1942. En tant que cause immédiate et adjuvante c'est la constipation qui a été rencontrée le plus souvent, et cela dans plus de 50 % des cas. On a en général accordé trop peu d'attention aux mauvaises conditions sociales d'existence, considérées comme cause accessoire. La plupart de ces enfants provenaient de milieux moins bien partagés et dans plus de la moitié des cas revus, les soins avaient été absolument insuffisants.

Le prolapsus ne cause la plupart du temps que des troubles très insignifiants et sa tendance à la guérison spontanée est grande, d'autant plus grande que l'enfant avance en âge.

*Aussi le traitement doit-il être conservateur* au premier chef. L'enfant est gardé au lit, son régime est régularisé, on s'efforce de remonter son état général, d'empêcher qu'au moment de la défécation il fasse appel à la presse abdominale dans toute son étendue, ce qu'on obtient en le faisant déféquer en position couchée, ou bien les jambes pendantes s'il est sur le vase. Lorsqu'on a des raisons particulières de craindre une récurrence après son retour chez lui, ou quand la méthode conservatrice n'a pas conduit au but, l'indication opératoire se pose. Cependant, seule une petite minorité a besoin de l'intervention chirurgicale si l'on prolonge le traitement conservateur pendant un mois environ.

Trois méthodes opératoires différentes ont été utilisées à l'Hôpital d'Enfants de la Princesse Louise, à savoir celle de THIERSCH, celle de EKEHORN, et *la diathermie en stries*. Leurs résultats sont sensiblement équivalents, avec 85—90 % de guérisons durables. Ces dernières années, seule la méthode diathermique a été employée.

Si on l'exécute de la bonne manière c'est-à-dire en pratiquant 4—6 cautérisations longitudinales sur toute l'étendue du prolapsus, c'est elle qui est la moins dangereuse et qui, pratiquement ne donne lieu à aucune complication

*L'auteur la recommande donc comme la meilleure dans les cas où l'opération est indiquée pour des raisons médicales ou sociales*

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# Obstruction Following Gastric Resection and Gastro-Enterostomy.

By

RUDOLF BRANDBERG

Difficulty in the emptying of the stomach contents into the intestinal canal occurs fairly often after gastric resection and gastro-enterostomy, but in most cases it passes rapidly off without recourse to therapeutic measures of any radical nature. Only in a very small number of cases does the obstruction to emptying persist for any considerable time and necessitate surgical intervention to overcome it, or, proving intractable, lead to death. The postoperative complication in question has been given various names, some having reference to the cause supposed to underlie it. *Circulus vitiosus*, *regurgitant vomitings*, gastric atony, gastric dilatation, gastric ileus and spastic gastro-enteric block are those most frequently used.

The complication is characterized, as said, by a completely inhibited or an unsatisfactory passage of the gastric contents into the intestine, with the result that ingested food and secreted gastric juice are left stagnating in the stomach, into which flow in most cases biliary, pancreatic and duodenal secretions. The gastric contents are then either vomited or have to be withdrawn by means of a stomach tube. If the obstruction fails to be relieved within a few days, the loss of these digestive fluids with the ions contained in them and the ensuing inanition leads to a rapid deterioration in the patient's condition, followed as a rule by death within a shorter time than two weeks, mostly with some complication as the proximal cause. In the majority of cases the symptoms of obstruction appear as soon after the operation as secretion has started in the digestive canal and its glandular

apparatus and food has been ingested, i. e. as a rule on the second or third day after the operation. Only in rather rare cases do the symptoms delay appearing until several days after the operation, the obvious assumption then being that the stomach emptying had been good or at least satisfactory at first and that the obstruction had developed later.

During the first decade of gastric surgery, when the usual operation for ulcer was long loop anterior gastro-enterostomy without entero-anastomosis, severe obstructions were considerably more frequent than they are in these days. The introduction of entero-anastomosis in anterior gastro-enterostomy and short loop posterior gastro-enterostomy led to a distinct diminution in the frequency of this complication. Respecting its incidence in more recent times there are the following data in PERMAN'S monograph on the surgical treatment of ulcer (1935). In PERMAN'S own material from the nineteen-twenties, vomitings of the gastric retention type occurred in about one-third of cases after gastro-enterostomy and in about one-half after resection (Billroth I or II). In the same work the frequency of severe obstructions after gastro-enterostomy and resection for ulcer in Sweden during the years 1923—1927 is given as 122 cases (2.68 %), 83 (1.82 %) of which with lethal issue, in 1552 operations. As the total mortality of the material was 471 cases (10.35 %), gastric obstruction thus accounted for about 17.6 % of the deaths. In absolute figures this means that at least 11 and at most 22 persons died annually from this complication during the period in question.

According to PERMAN'S investigation the frequency of severe obstructions after the different forms of operation was as follows:

After gastro-enterostomy	2.16 %
» resection, Billroth II	2.30 %
»        »        »        I	3.42 %

There has probably been no appreciable decline in the frequency during the period that has elapsed since PERMAN'S work was published. For instance, WALTERS (Mayo Clinic) in 1937 gives the frequency as 1—2 %. ALLAN and WELCH (1941) have no fewer than 15 cases of severe obstruction, including four deaths, among 282 cases of gastro-enterostomy and resection for ulcer and cancer, i. e. an average incidence of 5.3 % with a mortality of 1.4 %. The frequency of the complication after the different forms of operation is the same in ALLAN and WELCH'S smaller material.

as in PERMAN's, viz highest after Billroth I, less after gastro-enterostomy, and least after Billroth II

It is, however, very striking that this complication is not dealt with in many of the numerous publications on the surgical treatment of ulcer disease. In these materials it does not seem to have occurred at all, or possibly in a single case or two whereas it occurred in not so slight a degree in other materials, as can be seen from the above-cited figures. There would thus seem to be an inexplicable variation in its occurrence. The complication of grave obstruction is alleged to fall upon almost exclusively male patients. WALTERS states that obstruction mostly occurs in fat persons with a fatty mesocolon and small stomach situated at a high level. According to PERMAN's investigation, difficulties in stomach emptying appear only with a very slightly increased frequency in patients who had retention before the operation.

The causes of obstruction following gastro-enterostomy and resection of the stomach are still unclear and are the subject of the most varying opinions. The difficulty experienced in coping with this etiological problem is no doubt due to the following circumstances.

In second laparotomies on patients with high-grade obstruction, and in autopsies on patients dying from this complication, the finding has been quite negative in the majority of cases. The anastomoses established have been found to be satisfactorily wide, kinks and spurs or other changes in the ostia have not been observed, nor any appreciable dilatation of the afferent portions of the digestive tube. Only in a small number of cases have the inflammatory changes in the anastomoses and then adjacent tissues (productive peritonitis, *péritonite sousmesocolique aigue*, DUVAL et al) been demonstrable. Severe changes of this kind with the gastro-enterostomy area embedded in fixed, hard adhesions, may manifestly at once be interpreted as having caused the obstruction, but such grave changes are seldom observed. In minor changes of this type their significance for the obstruction has in many cases been uncertain. The result of these observations has accordingly been that gross changes do not as a rule exist in obstruction.

Another circumstance that has made the cause of obstruction a difficult question to solve is that such essentially dissimilar operations as Billroth I, long loop anterior gastro-enterostomy

(with or without resection) with entero-anastomosis as well as short loop posterior gastro-enterostomy (with or without resection) without entero-anastomosis have all led to in many respects similar conditions. The origin of this morbid state after operations so different in type has offered a very knotty problem.

Lastly, the results of the various procedures undertaken to remedy the obstruction have contributed to increasing rather than to dispelling the uncertainty respecting its origin. To therapeutic measures aiming only at removing the stagnating contents and to operations aiming at abolishing the obstruction, it is equally applicable that they sometimes lead to good results and sometimes afford no benefit. Consequently, it would seem impossible to arrive at an opinion of the nature of the obstruction with the guidance of the therapeutic results attained, since these are open to the most diverse interpretations.

The views as to the cause of obstruction following gastro-enterostomy and gastric resection vary between two poles, except of course in regard to the few cases in which a veritable state of ileus of one form or the other has arisen. On one hand, it is claimed that the obstruction is mechanical in nature, on the other that it is functional.

Formerly, the mechanical cause of obstruction was chiefly sought in distension of the afferent loop and compression of the efferent one as a result of kinks and spurs. Later, it has been thought that in posterior gastro-enterostomy (with or without resection) too powerful an upward pull with a consequent compression of the loop in the slit in the mesocolon may create a mechanical obstruction to passage. This condition occurs at large resections, in patients having a small, high stomach or fatty mesocolon (WESSON, WALTERS, ALLAN and WELCH, and others). An abnormally short or fibrously changed mesocolon is also considered capable of causing obstruction. The middle colic artery has likewise been given a causative rôle on the ground that it exerts pressure on the gastro-enterostomy area and prevents passage through this. Many have seen the principal cause of mechanical obstruction in inflammatory changes in the region of the sutures. The wound in the wall of the digestive canal, of course, never heals by first intention, healing taking place with more or less pronounced inflammatory changes. When these changes are considerable, it is thought by, among others, ALLAN and WELCH that the swelling may reach such dimensions as to make

passage through the lumen impossible. Inflammatory changes in the mesocolon after posterior gastro-enterostomy have also been assumed capable of becoming so pronounced that they compress the stoma and prevent passage through it. The frequently repeated advice to stitch the opening in the mesocolon to the wall of the stomach at as great a distance as possible from the gastro-enterostomy is given to prevent a potential inflammatory swelling from exercising its greatest pressure on the most delicate point in respect of passage, viz the gastro-enterostoma. Inflammatory changes of this kind are fairly unanimously considered to rank first as the usual cause of the obstruction when this appears after a short while's free interval. In recent years several authors (WESSON, etc.) have assumed a powerful oedematous formation of colloido-chemical origin in the anastomotic region as the cause of the difficulties in passage. Low colloid osmotic pressure due to reduced serum protein gives rise to a tendency to oedema, and this oedema locates itself with predilection in tissues lesioned by operative interference. The chemical blood changes in question appear in gastric diseases which involve the possibility of defective nutrition for the patient and, above all, which cause persistent vomitings. A low serum protein in itself also leads to reduced gastric motility, just as does a low sodium chloride level. According to MECROY, BARDIN and RAVDIN, the motility of the stomach is inversely proportional to the value of the serum protein. The abundant extra-oral supply of fluid now used after operations on the stomach undoubtedly increases this tendency to oedema.

A study of the above-cited suggestions that have been advanced in explanation of mechanical obstruction will show that several of them can hardly be correct. Kinking and spurring have extremely seldom been demonstrated at second laparotomies or autopsies. Inflammatory swelling of the wall of the alimentary tract at the site of the anastomosis can scarcely be conceived to become so powerful that a passage, which usually has a width of two fingers, should become impassable. A comparison with the conditions in the choleduchus and ureters would seem to afford a strong corroboration of this. These excretory ducts, which are often the seat of inflammatory changes and in which considerable quantities of fluid have to pass through long and narrow canals, very rarely become so swollen that obstruction to passage arises. And yet the chances of this happening here are many times greater.

than in gastro-enterostomy. Direct observations show, in fact, that a passage is actually maintained from the afferent loop to the stomach and *vice versa*. Thus in obstruction following gastro-enterostomy with or without resection, the stomach contents are almost always bile-stained. Roentgen pictures of patients suffering from obstruction after e. g., Billroth II not infrequently show that the stomach empties into the afferent loop. As the anastomosis is thus traversable in the afferent loop to stomach direction and the reverse it does not seem reasonable to assume that swelling would prevent passage into the efferent loop. The possibilities of nutritional oedema arising have doubtless been very much overrated. The chemical blood changes forming a necessary antecedent to oedema of this type occur essentially in extreme cases of pyloric stenosis and are then made the object of adequate treatment before operation is undertaken. Otherwise, such changes do not occur before the operation, but develop as a consequence of the obstruction. When the blood changes in question are demonstrable, they are thus usually the consequences of the obstruction and not its cause.

On the other hand to me it seems quite clear that the mesocolon can cause obstruction in various ways after posterior gastro-enterostomy. The conditions under which this may occur and the mechanism involved will be more closely discussed below.

The opposite view attributes the cause of obstruction after gastro-enterostomy and gastric resection to disturbance in the motor function of the stomach and intestine. Besides relying on the above-stated fact that frequently no mechanical obstruction or a dubious one is demonstrable, the advocates of this view seek support for their opinion in the known fact that the motor activities of the stomach are easily disturbed, with marked paresis as a consequence.

Acute dilatation of the stomach is a rare state that can be initiated by the most diverse causes, e. g. overfilling of the stomach, trauma, various operative interferences. It is stated that the disease is mostly found in a certain type of persons, viz. tall, asthenic individuals with dysharmony of their autonomic nervous system and mainly vagotonal symptoms. What is primary in acute gastric dilatation is, according to the general view gastric paralysis, mostly combined with a high degree of hypersecretion. The gastric dilatation then draws with it compression of the distal part of the duodenum, so-called arteriomesenterial

compression. In a rare case or two the same state may doubtless occur in the reverse direction viz a primary antemesenteric compression with secondary gastric dilatation.

The paresis that affects the digestive tract in peritonitis often involves the stomach more than the intestine. The old observation that establishment of a gastrostomy may completely change the morbid course in peritonitis receives its natural explanation in fact that gastric atony has played a dominant part in the picture of such cases.

A good opportunity of studying the power of the stomach to empty after excision and suturing of a perforated gastroduodenal ulcer is afforded in the gastrostomy which, as a rule, is established at the operation. According to a collection made by PERMAN, 9 of 20 patients who recovered retained about 500 c c of fluid as early as the second day after the operation, and only 4 patients had a negative balance more than 3 days. A collection made by me of the emptying conditions in the same disease and under the same operative conditions showed, however, considerably more unfavourable figures. In 52 cases of perforated ulcer operated upon with a successful after-course the patients had, on an average, a negative balance for 2—3 days — with a maximum value in 8 days — and gastric passage was not fully clear until after 6—7 days — with a maximum in 12 days. Only one case had satisfactory passage from the beginning, in all the others this was more or less disturbed.

Clinical observations testify to the fact that considerable gastric atony not infrequently occurs after anaesthesia. On the other hand, lumbar anaesthesia, involving as it does paralysis of the inhibitor nerve (sympathicus) of the digestive canal would no doubt rather have the opposite effect on the gastric as well as intestinal motility. Acute gastritis likewise leads to an inhibition of gastric motility. In connection with stomach operations it is more especially the decomposing blood in the stomach that causes gastritic changes, which contributes to lowering the gastric motility. That various states of infection outside the abdominal cavity, e g pneumonia, are not infrequently accompanied by reduced gastric motility is also a general observation. Acidosis is certainly a factor that has a depressive action on gastric motility. The intense acidosis of diabetic coma leads to marked gastric atony. Confinement to bed has been put forward by GOETZE as a factor conducing to increased postoperative difficulties in

emptying In the recumbent position the stomach has to empty against hydrostatic pressure To eliminate this mechanical factor GORTZE allows his patients to occupy the 'semi-sitting position' in bed

The above clinical observations showing that the motor function of the stomach is easily disturbed are supplemented by numerous experimental investigations, partly undertaken with a view to elucidating the mechanism underlying gastric paresis

PAYER has shown that anaesthesia of experimental animals results in gastric paresis for 12—24 hours If the stomach of the experimental animal is inflated during the anaesthesia pronounced dilatation is obtained (KELLING)

STIEDA has succeeded in experimentally producing dilatation of the stomach by closure of the pylorus and establishment of a gastro-enterostomy with simultaneous section of the vagus nerve

CANNON and MURPHY have shown that after being subjected to mechanical manipulation the stomach does not begin to empty until after 3—4 hours and that the paresis lasts the longer the more powerful the traumatism has been

Loss of gastric peristalsis following traumatism is due to inhibitory reflex In extraperitoneal traumatism the inhibition does not occur if the splanchnic nerves are severed, in intraperitoneal traumatism it arises in spite of nerve section OLIVECRONA has shown, however, that the peristaltic inhibition following abdominal trauma is greatly reduced if the coeliac plexus has been extirpated

That postoperative gastric atony may play a considerable part in retarded emptying after gastro-enterostomy and gastric resection is immediately clear The question is, however, whether gastric atony can cause prolonged obstruction, as is assumed in such cases as those in which no mechanical obstruction is demonstrable An attempt will be made below to assess the rôle and significance of gastric atony as a cause of obstruction

Atony of the intestinal canal occurs under the same conditions as that of the stomach, but probably plays less part in the obstructions now under discussion

An endeavour has also been made to explain the obstruction on the assumption of a spastic postoperative condition — 'gastro-enteric block' The spasm has been interpreted as being caused by dominance of the parasympathetic brought about by paresis of the sympathetic, susceptibility to spasm on account of fluid

and ionlosses due to vomitings being considered an important contributing factor. This theory set up by REISCHAUER, however has only found a few advocates, having been rejected by most observers. All clinical and radiological observations show, in fact, that a paresis and not a spasm follows operation.

Besides the opinions set forth above as to the nature of the obstruction, there are also those that ascribe the cause to the interaction of the factors mentioned. To cite the views of all the authors who have dealt with this problem would be tantamount to an unfruitful recapitulation of what has already been stated in this paper. The greatest agreement seems to exist (PERMAN, WALTERS, etc.) in interpreting the late obstructions as mechanically conditioned and due to inflammatory changes round the site of the anastomosis. As a further reason for this interpretation WALTERS states — without direct observation of the change — that these patients often have a sub-febrile temperature.

The directions given by the different authors for avoiding obstruction after gastric resection and gastro-enterostomy follow naturally from the causes they postulate for this complication. When changes in the mesocolon in the form of abnormal fattiness, scarry thickening, or insufficient length can be considered to lead to obstruction, a posterior gastro-enterostomy is not advised, an anterior one then being recommended instead. The posterior gastro-enterostomy is also not considered advisable when unusually large resections are concerned. That the technical directions generally given for gastric resection and gastro-enterostomy are not in all cases of a nature to prevent obstruction is at once clear. Quite obviously, a careful study of the technical conditions of the operation with a view to avoiding obstruction is desirable. However, as can be seen from what has been stated above, many authors consider the obstruction to be due to atony, spasm, inflammatory changes, i. e. conditions that are impossible or at any rate very difficult to foresee and preclude. Their opinion, therefore, is that no surgeon can guard against the complication in question, this being liable to intervene even after technically successful operations.

The first measure resorted to in treatment of gastric obstruction is emptying of the stagnant contents of the stomach by repeated gastric lavage or, still better, by permanent suction through an indwelling duodenal sound. It must be considered as excluded that the patient can empty the stomach completely.

by vomiting. This treatment ought to be instituted immediately. Suspicion arises of stagnation in the stomach. The emptying of the stomach obviates the risk of secondary paresis as a consequence of the distension, and thus creates favourable conditions for the recovery of motility. Its immediate effect is usually very striking, the distressed state of the patient disappears, his weakened pulse improves, and so on. Treatment of this kind continued over a couple or a few days will overcome a large number of cases of obstruction. It is supplemented by the extra-oral administration of fluid, sodium chloride and glucose as well as by blood or plasma transfusion in cases where the serum protein exhibits a falling tendency.

If the obstruction cannot be induced to yield within a few days by the above-mentioned procedure the question of further therapeutic measures arises. ALLAN and WELCH advise that such interventions should not be delayed more than one week in the case of patients above 50 years and possibly, a little longer in younger persons. Should the obstruction persist for a considerable time in spite of the therapeutic procedures mentioned, the patients become so debilitated that they do not tide over an operation but succumb to some complication.

The numerous operations that have been proposed and performed in these severe cases of obstruction may be divided into two groups I and II. Group I consists of those designed to divert the stagnating stomach contents and render possible a supply of nutriment to the digestive tract below the obstruction. Hence these measures do not aim at abolishing the obstruction, it being hoped that this is of such a nature that it will disappear of itself after some time. The second group consists of operations directly aiming at eradicating the obstruction or by-passing it by the establishment of a new anastomosis. The commonest measures within the first group are gastric fistula and jejunostomy. Solely the establishment of a gastric fistula obviously means only a continuation of the drainage treatment of the stomach, although for the patient it is perhaps a less embarrassing method than permanent suction or repeated stomach washings. According to PERMAN'S investigation, 17 cases of 36 recovered with this treatment. Jejunostomy is established exclusively for nutritional purposes. The jejunostomy is in most cases also used as a means of returning to the body the gastric contents withdrawn from it, this in order to avoid loss of the digestive fluids with their

salts and ferments. The following results of jejunostomy treatment may be submitted. PERMAN, 5 cases with 4 deaths. WESSON, 7 cases with 1 death, ALLAN and WELCH, 15 cases with 4 deaths. In many of WESSON's and ALLAN's and WELCH's cases there was a delay of up to four weeks before normal emptying took place. If gastric fistula and jejunostomy are simultaneously established, communication can be arranged between stomach and intestine outside the abdomen 'external gastio-enterostomy', as in a successful case described by NYSTROM.

According to statements in PERMAN's work surgical measures referable to group II have given the following results:

New gastro-enterostomy	36 cases with 28 deaths,
Entero-anastomosis	25 cases with 4 deaths,
Separation of adhesions	5 cases with 4 deaths,
Removal of gastio-enterostomy	6 cases with 3 deaths

To relieve the obstruction HOAG and SAUNDERS carry out jejunoplasty, i. e. an operation analogous to pyloroplasty, and report 4 cases all with a successful outcome.

From what has been stated in the foregoing it is evident that mechanical obstruction is only demonstrable beyond all question in a small number of cases of passage obstruction following gastro-enterostomy and gastric resection. Thus, the common causes of the obstruction must be sought, not only in the mechanical relations, but above all in such functional disturbances as can be the consequence of the operation performed. The natural starting-point for a study of the problem ought therefore to be the normal physiological motor phenomena of the stomach and upper part of the small intestine as well as those disturbances which they may sustain from the operations performed.

According to the commonly accepted rule, the musculature in this case the non-striated, will be parietic if it is distended beyond a certain point. In the surgical procedures in question here there is a risk that such may occur. The cardiac and pyloric regions of the stomach as well as the duodenum are fixed fairly securely to their surroundings and are thus comparatively immobile. Should so large a part of the stomach be removed that excessive tension arises on suturing the resected surfaces to each other (Billroth I), paresis due to distension will be the result. The same condition may occur if the loop used for the anastomosis in a gastro-enterostomy is taken too short. The oral end of the loop --

the duodenojejunal flexure — is of course firmly seated and immobile. Distension paresis is probably caused at least partly, by circulatory disturbances brought about by the overstretching. The arrangement of the vessels in the stomach and uppermost portion of the small bowel (the latter will be more closely discussed below) is such that circulatory disturbances and with them paresis are especially likely to arise here. Beyond the distension, which thus need not be at all high-grade, a parietic bowel segment of this kind exhibits no macroscopic changes. Unless the distension is too excessive, the circulation improves successively and the musculature re-organizes itself to the new level of tension, with the disappearance of the paresis as a result.

Another way in which paresis due to over-distension can arise is through stagnation of more especially the fluid contents of some portion of the alimentary tract. This distension asserts itself perhaps more in a circular than in a longitudinal direction.

Another generally accepted rule is that if a parietic area exists in the digestive canal this will be the seat of retention and distension as a consequence. The accumulation of intestinal contents in the area in question does not take place only in the peristaltic direction but also in the antiperistaltic. If a parietic area of this kind is side-tracked by the establishment of an anastomosis (as in gastro-enterostomy) or forms an antiperistaltically directed *cul de sac* (as in Billroth II), the area in question will be overfilled and distended and the passage down into the intestinal canal will be unsatisfactorily or entirely abolished. Owing to the fact that the parietic stretch of intestine in this case stands in wide communication with the stomach, from which the contents can be emptied by vomiting or by gastric sound, the distension of the parietic area will not be intense and the condition will thus not be so manifest as in lower parts of the digestive tract.

The motility of the stomach, as previously mentioned, is easily disturbed so that an atonic condition is liable to arise. Traumatism of the organ in gastric operations as well as the infection involved in them must be considered to be the most important element in the production of paresis. The cause of the varying degrees of gastric atony that arise under similar conditions in different persons is doubtless to be sought in constitutional conditions, especially nervous ones. Further, if hæmorrhage from the suture area occurs into the postoperative pare-

tic stomach, the stagnant blood will decompose and cause gastritis, which contributes to and prolongs the paresis. No doubt the gastric atony produced by these factors taken together need not be especially protracted. After gastro-enterostomy without simultaneous resection more favourable emptying conditions may doubtless be expected than after an operation for perforating ulcer, since in the former case the infection in the abdominal cavity is only minimum, and the emptying ought to take place more easily through the gastro-enterostomy than through the pylorus, which is often the seat of an ulcer and hence narrowed at the stitching and may also be assumed to be spasmodically closed. In view of this and of what has been previously said regarding the emptying conditions after an operation for perforating ulcer, one may thus venture on theoretical grounds to draw the conclusion that obstructed passage due to gastric atony probably does not last longer, with rare exceptions, than two or three days after the gastro-enterostomy. Obstruction of longer duration must, as a rule, have another cause. No material that can illustrate the emptying conditions after gastro-enterostomy is at my disposal, as for about 15 years past I have only employed this operation for pyloric stenosis in old patients for whom resection has been considered too extensive an operation, that is to say, very seldom. However, from experiences during an earlier period, when gastro-enterostomy was widely employed, I have the impression that emptying difficulties were if anything commoner after this operation than after resection.

If gastric resection is performed in addition to gastro-enterostomy, and the stomach is thereby reduced by one-half, it is certainly not absurd to assume *a priori* that the risks of retention on account of atony will diminish rather than increase. GOETZE and others consider that the stomach must be interpreted as a functional unity in which the emptying is essentially conditioned by a long increased tonus — the "gastric systole". According to these authors, the function of the peristaltic waves is more to mix the stomach contents together than to transport them into the intestine. Removal of the pyloric half of the stomach cannot then, be considered to involve any impairment of the motor function of this organ. The removal of the pyloric sphincter, which by its spastic state may cause retention, ought also to have a favourable effect upon the emptying, this, of course, taking place after resection through an ostium that has no sphincter. Long

established experience has shown that the injuries sustained at gastric resection by the nerves and vessels supplying the stomach have little or no influence on the motility. Theoretically, there is thus the more reason to assume that in the absence of special conditions a resected stomach should empty easier than an unresected one.

Of 89 gastro-duodenal ulcer cases resected by Billroth II during the period May 1940—April 1944, 65 showed no signs whatever of postoperative retention. The great majority of these patients did not vomit at all, while the others only ejected a very small amount of, as a rule blood-stained, fluid on solitary occasions. A further 13 patients had normal emptying conditions not later than the third day after the operation. Among the 11 remaining patients, the emptying conditions cleared up in 7 cases under conservative treatment not later than the ninth day after operation. In 4 cases, which will be reported at greater length later, a secondary operation was necessary.

Gastric atony has been rejected on theoretical grounds as a cause of other than short-lived obstructions after resection or gastro-enterostomy. The above-cited observations on the emptying conditions following resection according to Billroth II also seem to suggest that in those cases in which there were emptying difficulties these had special causes and were not brought about by an atony of the stomach or intestine.

Although gastric atony can only be accepted as the cause of rather short-standing obstructions, it would obviously be a very great advantage if a somewhat less interfering means than stomach washing were available against it. General experience shows that the normal intestinal peristalses are ineffective. Several authors (BALATOV, CARLSSON, J. LE BARRE) have shown that insulin leads to an increased gastric motility, but attempts to utilize this observation therapeutically have not had any notable result.

Hence, as there is no possibility of preventing the occurrence of gastric atony and no effective and lenient method of treating it when it has occurred, this fact must be taken into account at the assessment of the indications for operation. Stomach operations on relative indication ought only to be performed on patients who can sustain the stress of the gastric atony.

Whereas there are numerous observations on gastric motility and great attention has been directed to this phenomenon, the

opposite is the case with regard to that of the small intestine DRAGSTEDT, LANG and MILLET have shown that different parts of the intestinal tube tolerate highly different pressures before the blood circulation in the intestinal wall stops. For the duodenum, jejunum, ileum and colon these authors give pressures of 35, 45, 55 and 95 mm Hg respectively. They seek the cause of this condition in the different course of the vessels in the muscular wall of the intestine. In an experimental work on bowel movements in ileus (1939) I have shown that in obstruction of the upper portion of the small intestine the part of the digestive tract situated above the obstruction is quickly distended and does not then exhibit any motility whatever. In obstruction located distally in the small as well as the large intestine on the other hand, peristalsis continues orally to the obstruction for days, almost until the experimental animal dies. This observation is in full agreement with the finding of DRAGSTEDT, LANG and MILLET that those parts of the intestinal canal which only tolerate a low pressure before circulation ceases ought, obviously, to become rapidly parietic if they are distended, while those parts which tolerate greater pressure may become more distended before peristalsis ceases. These experimental observations are probably also applicable within human pathology. The fact is that the underlying anatomical conditions are the same in human subjects as in the experimental animals. It is an old observation that high intestinal obstruction produces hardly any of the classical symptoms of ileus, which at any rate to some extent must be ascribed to the rapid onset of intestinal paresis. The following case illustrates this.

A woman of 41 years with callous duodenal ulcer was treated on May 30, 1940, by resection according to Billroth II. POLYA, antecolic terminolateral long loop gastro-enterostomy and entero-anastomosis between the afferent and efferent limbs of the latter were performed. The postoperative course was normal until June 14, when the patient began to have bile-stained vomitings. She noticed no pains in the abdomen. As proper passage could not be obtained after conservative treatment, and the patient continued to vomit daily, a second laparotomy was undertaken on June 27 and an omental adhesion was found about the lower part of the entero-anastomosis, which part from the left crossed in front of the efferent loop. There was no distension of the afferent and efferent loops of the gastro-enterostomy. The adhesion was ligated and released. After the operation the vomitings diminished but did not cease, and the emptying thus continued to be unsatisfactory. On June 29, a jejunostomy was established on the afferent

loop for nutritional purposes. Unhindered emptying took place first on July 14, and on July 18 the fistula was removed. The patient was discharged healed on Aug. 5.

This case shows that an omental bend exerting but little constriction suffices to cause obstruction to passage, and that this does not give rise to any real pain. The intestinal obstruction did not bring about any considerable distension above the obstruction because the stagnant contents were vomited or removed through a stomach tube. In spite of this the resultant paresis was extremely prolonged.

Obstruction following gastric resection and gastro-enterostomy as well as the results of different forms of treatment admit very well of being explained from the starting-points given above. Of course, the main cause of the obstruction varies after different operations as well as after the same operation. Different main causes may be active. A survey of the usual causes of the obstruction after the different operations may therefore be given.

After resection according to Billroth I the common cause of gastric obstruction is the distension-paresis that may arise from the suturing of the resection-surfaces to each other. As previously stated, it is evident that occlusion by a swelling of the lumen at the site of the suture cannot be the cause of the defective emptying, among other things for the reason that the vomited or tapped gastric contents are not uncommonly bile-stained. The therapeutic measure from which there is reason in this case to hope for a favourable effect is removal of the stagnating contents by repeated stomach washings or permanent suction. By this means distension of the stomach and its resultant secondary paresis are avoided. In mild cases the distension-paresis yields after two or a three days' treatment of this kind. The problem in severe cases, in which the paresis takes 2—3 weeks or perhaps more to subside, is to prevent disturbances in the fluid and salt balance as well as inanition from developing during this long period. When this is not possible to achieve by extra-oral administration of sodium chloride- and glucose-solutions and blood transfusions, jejunostomy for nutritional purposes is a suitable operation. Should it be possible to pass a duodenal sound through the stomach into the intestine, this is a still more convenient means of attaining the same end. An operation to which frequent recourse is had for prolonged obstruction to passage is gastro-enterostomy, as a rule the anterior type with a long loop and entero-anastomosis.

This procedure is not rational, since gastric paresis and not defective passage is the cause of the obstruction, and if anything the former is increased by the new operation. In those cases in which gastro-enteric passage is restored after the second operation, the result is to be classed as *post not propter* to the operation.

The fact that no technical measure exists for avoiding gastric obstruction after Billroth I — the size of the resection must of course be adapted to the patho-anatomical conditions — adds yet another reason to the many others for restricting the use of this method of resection.

In anterior (antecolic) gastro-enterostomy (with or without resection) with entero-anastomosis the common cause of an obstruction that falls outside the scope of what can be considered due to postoperative atony is that the loop used for the gastro-enterostomy has been taken too short. The afferent loop then becomes too greatly distended and, as a consequence, parietic. In this loop — which is either to be regarded as a side track (in cases without resection) or as an antiperistaltically directed *cul de sac* (in cases with resection) — bile as well as pancreatic and duodenal juices are retained, to be forced up afterwards into the stomach. The gastric contents, on the other hand, are emptied into the afferent loop. Very little or none at all is emptied into the efferent loop, partly because emptying proceeds more easily into the afferent, dilated, parietic loop, partly because the efferent loop does not receive any peristaltic impulses from the parietic stretch of bowel located orally to this. Indeed, the whole of that portion of the intestine which is included in the gastro-enterostomy must be regarded as parietic.

The parietic and dilated afferent loop mechanism as a cause of obstruction is corroborated and instructively illustrated by the following recently observed case.

A man, aged 63 years, with gastric ulcer (suspected to be cancer) on the lesser curvature close to the pylorus was submitted to resection according to Billroth II — POLYA, Aug 18, 1944. As the mesocolon was both short and fatty, an antecolic terminolateral gastro-enterostomy with long loop and entero-anastomosis between the afferent and efferent limbs was carried out. After the operation the patient had fever due to bronchitis of the asthmatic type with bronchopneumonias. The first four days after the operation the patient had a few small vomitings consisting of dark blood-stained fluid. Symptoms then developed of pronounced obstruction with gastric retention of wellnigh one litre of bile-stained fluid per 24 hours. No improvement was ob-

tained by ordinary evacuation treatment and therefore a second laparotomy was done on Aug 27 for the establishment of a nutritional fistula on the jejunum. The discovery was then made that the inner layer of the operative wound had slipped up and that the aboral part of the afferent gastro-enterostomy loop was adherent to the anterior abdominal wall and had partly penetrated into the rupture cavity. The loop presented a swollen, thickened wall covered with fibrin and there was considerable dilatation extending right up to its point of inoculation with the stomach. No changes whatever were present in the efferent loop of the gastro-enterostomy and the area of the entero-anastomosis. The intestinal loop was released and the operative wound resutured. Emptying then proceeded apparently without obstruction. On the second day after being relaparotomized the patient died from pulmonary complication. Autopsy confirmed the observations made at the second laparotomy.

Thus to obviate obstruction after the type of gastro-enterostomy now in question the loop for the gastro-enterostomy must be taken sufficiently long. The classical length of the loop is 50 cm but this dimension must be measured on the contracted intestine, which corresponds to about 75 cm on the lax bowel. First at this length can one be sure of having taken a sufficiently long loop even when large resections, fat persons with a fatty omentum, or patients with a tendency to colonic meteorism are concerned. As adhesions are liable to arise at the point where the gastro-enterostomic loop crosses the transverse colon, a liberal length of loop ought to be taken for this reason as well. If this is not done, the adhesions may lead to strappings, which reduce motility and may even entirely arrest it. Paresis due to distension is probably never so severe that it does not abate spontaneously within a shorter or longer period. In those cases in which the paresis yields after a relatively short time, treatment on the usual conservative principles will suffice. In more severe cases in which the paresis does not subside until after a long period a nutritional fistula on the jejunum is the most suitable procedure. That an entero-anastomosis between the afferent and efferent limbs of the gastro-enterostomic loop reduces the risk of obstruction is incontestable. When there is a moderate diminution of the motility in the afferent loop a certain amount of emptying always takes place through the entero-anastomosis into the efferent loop, whereby stagnation with distension and increased paresis is avoided in these cases. However in more serious cases of distension-paresis of the afferent loop the entero-anastomosis does not suffice to prevent the above-mentioned mechanism from developing.

The following case derived from the author's early work illustrates the obstruction mechanism in question here

A man of 39 years with a duodenal ulcer penetrating into the pancreas was subjected on March 28, 1938, to a resection according to Billroth II — POLYA's method, with antecolic gastro-enterostomy and entero-anastomosis. The stitching over of the duodenal stump was troublesome on account of diffuse indurated adhesions in the ulcer area. After the operation there was no downward passage into the bowel. On April 4, a nutritional fistula was established in the jejunum. The next day there was a rise in temperature on account of pulmonary complication, and on April 6 insufficiency of the duodenal suture followed with exitus the same day. Autopsy showed — and this is of special interest here — that the afferent loop of the gastro-enterostomy was under strain from the extremely meteoristic transverse colon.

In posterior gastro-enterostomy (with or without resection) performed with a short loop passed through a hole in the mesocolon, obstruction falling outside the scope of gastro-enteric atony can also, of course, be caused by the fact that the loop used for the gastro-enterostomy has been taken too short. This is more likely to occur after large resections where the same conditions as those described below are liable to intervene. After resections up to the limit of the right and left vascular areas of the stomach posterior gastro-enterostomy is always of service, with the exceptions mentioned below, but after larger resections it is safer to employ the long loop anterior gastro-enterostomy with entero-anastomosis.

The common cause of obstruction after posterior gastro-enterostomy, however, is changes in the mesocolon in the form of abnormal shortness, pronounced fat content, or fibrous thickenings. In all of these changes the mesocolon is deprived of those properties of suppleness and motility which form an indispensable condition for unhindered passage through the posterior gastro-enterostomy. With a changed mesocolon the area of the suture to the stomach wall — in most cases, thus, the region of the gastro-enterostomy — is exposed to direct pressure, and compression of the limbs of the gastro-enterostomic loop takes place. These conditions are sufficient to prevent passage owing to the low motility possessed by the upper part of the small intestine. The mechanism that then develops may no doubt be assumed to be as follows. The secretions flowing into the afferent loop stagnate in this, and the bowel portion in question dilates and becomes paretic. When the pressure in the loop has increased sufficiently to overcome

the resistance from the mesocolon, the contents of the-loop are discharged up into the stomach and passage between the latter and the afferent loop is established. No emptying takes place into the efferent loop, for reasons previously mentioned, to which comes the fact that the compression of the efferent loop still further increases the difficulty of emptying. There thus arises the same functional state as when the loop for the gastro-enterostomy is taken too short, viz a parietic afferent loop with its resultant obstruction to passage.

If a posterior gastro-enterostomy is performed in conjunction with large resections, the mesocolon is pulled up tent-like and the gastro-enterostomic loop is squeezed within its slopes. Hence a similar condition arises as that in mesocolonic changes.

A couple of other facts may be pointed out respecting cases in which changes in the mesocolon are the principle cause of the obstruction. In the vicinity of the gastro-enterostomy there invariably arises a certain amount of inflammatory reaction with oedematus swelling. Not infrequently the situation is doubtless this, that the mesocolonic changes, which *in et per se* would not have produced obstruction, do so if an inflammatory swelling supervenes. In the case of a fatty mesocolon inflammatory swelling is more likely to arise than otherwise, and then it also attains higher grades. Fibrous changes in the mesocolon are the result of repeated or continuous infection, in most cases lymphogenically from the ulcer. The lymph tracks in a mesocolon changed in this way must be considered to be chronically infected, and after operative intervention the infection is very liable to flame up. After posterior gastro-enterostomy in such cases the area of the operation may after a short time become embedded in fixed, hard adhesions, with obstruction as a sequel.

The following cases are examples of the grave emptying difficulties that may arise when posterior gastro-enterostomy is used in cases with a changed mesocolon.

Male, aged 50 years, with a callous duodenal ulcer. On Nov 6, 1942, a gastric resection and terminolateral posterior gastro-enterostomy was performed. The mesocolon was fibrously thickened. Obstruction followed the operation, and therefore on Nov 14 a nutritional fistula was established. Normal emptying was already obtained on Nov 17.

Male, aged 44 years, corpulent, with a penetrating duodenal ulcer of several years' standing. On April 9 1943, gastric resection was done (Ausschaltung) with a posterior terminolateral gastro-enterostomy.

laid through an opening in the mesocolon, which was extremely fatty. Obstruction occurred after the operation, and therefore on April 16 a nutritional fistula was established in the jejunum. A few days later leakage started from the site for the suture of the fistula, and therefore the latter had to be sutured (April 28). Unobstructed emptying was never attained. On April 30 the patient had cerebral haemorrhage with haemiplegia, and died on May 4.

Male, aged 43 years, with callous duodenal ulcer. On Jan 7, 1944, gastric resection with posterior terminolateral gastro-enterostomy was performed. The mesocolon was so short that the colon could not be drawn outside the operative wound. After the operation there was obstruction to emptying and therefore a nutritional jejunal fistula was established on Jan 14. The patient did not have satisfactory stomach emptying until Feb 4. He has subsequently been completely free from trouble.

In two of the cases, thus, the obstruction cleared up spontaneously under recourse to a nutritional fistula to maintain the patient's nourishment. The same successful result would certainly have been expected in the third case if complications had not intervened. As a rule, therefore, it may be taken that the obstruction to passage is not more severe than that the intestine can accommodate itself to it and overcome it after the inflammatory swelling has had time to recede.

A scrutiny of the operation reports and other records referring to those cases among my material in which emptying difficulties were found of greater severity than could be assumed to be due to gastro-enteric atony, but which were relieved by conservative treatment, shows that not one of these cases had a fully normal mesocolon. Fibrous changes and an abnormal degree of fat have been principally concerned.

In the majority of cases with changes in the mesocolon the obstruction is localized to the area of the gastro-enterostomy, and then the usual clinical picture of obstruction is presented. However, if the changed mesocolon is stitched to the stomach at a good distance from the gastro-enterostomy, compression may take place on the stomach so that passage from the upper part of this organ down into the lower, including the gastro-enterostomy, is blocked, while below this point passage from the afferent loop of the gastro-enterostomy into its efferent loop is unobstructed. An example of this is afforded by the following case.

Male, aged 49 years, with callous duodenal ulcer. On Sept 13, 1943, a gastric resection with posterior terminolateral gastro-enterostomy

was performed. The mesocolon was fibrously changed. There was no stomach emptying after the operation, intaken fluid and gastric juice stagnating in the stomach. No signs at all of admixture of bile were found in the stomach contents. A second laparotomy was done on Sept. 19, when diffuse hard adhesions were found in the operative area. There was no distension of the afferent loop of the gastro-enterostomy, the passage from the latter over into the efferent loop having evidently been unhindered the whole time. Anterior gastro-enterostomy with entero-anastomosis was established, and a couple of days later stomach emptying was unobstructed. The patient was discharged well.

To preclude an obstruction characterized by the mode of origin described above it is necessary to employ posterior gastro-enterostomy only when the mesocolon is normal and not to use this type of operation in conjunction with large resections. In such cases anterior g. e. should be employed instead.

In those cases of obstruction of the nature now dealt with in which passage is not re-established after ordinary conservative treatment lasting about one week, a jejunal fistula for nutritional purposes should no doubt be the most suitable operation. The fact is that passage is usually spontaneously restored within a reasonable time viz. when the inflammatory swelling has disappeared and the bowel has had time to accomodate itself to the increased pressure.

When a posterior gastro-enterostomy has not functioned satisfactorily, an anterior one has not uncommonly been established. That in many instances this operation does not bring the intended effect is due to the previously cited fact that the stomach empties more easily into the parietic afferent loop of the posterior gastro-enterostomy. Stomach emptying through the new stoma thus becomes uncertain and may even fail to take place at all. Only when such a condition exists as that described in the case last cited is a new gastro-enterostomy a fully rational operation.

### Summary.

Surgical operations on the stomach are not infrequently followed by disturbances in the motor function of this organ, sometimes of greater, sometimes of less degree. A certain amount of intestinal paresis is also the consequence of these operations, especially of gastro-enterostomies. After gastro-enterostomy and gastric resection, therefore, we must be prepared to encounter obstruction to stomach emptying during a period of a couple to

a few days depending upon gastro-enteric atony. Obstructions other than those which can be considered to be due to gastro-enteric atony have either a direct mechanical cause or are due to distension-paresis brought about by the surgical intervention.

In resection according to Billroth I that distension of the stomach wall which arises at the suturing of the resected surfaces to each other may give rise to paresis, which causes serious obstruction to stomach emptying. Since a distension of this nature cannot be avoided after large resections and other conditions, this is one reason added to many others for restricting the use of this type of resection.

After antecolic long loop gastro-enterostomy (with or without resection) and entero-anastomosis between the limbs of the loop, the common cause of obstruction is that the loop used for the gastro-enterostomy has been taken too short, with the result that the afferent loop becomes too distended and consequently parietic. The stomach contents empty into this parietic portion of the bowel — which is to be regarded as a side track when the gastro-enterostomy is performed without resection and as an antiperistaltically directed *cul de sac* when resection is simultaneously performed — and no emptying or only unsatisfactory such occurs down into the efferent loop. In order to avoid distension-paresis under all circumstances the loop in this type of gastro-enterostomy ought to be taken at least 50 cm long, measured on the contracted intestine.

After posterior short loop gastro-enterostomy with or without simultaneous resection the obstruction may naturally likewise be due to the fact that the loop for the gastro-enterostomy has been made so short that it becomes distended and therefore parietic. The commonest cause of obstruction after this type of operation is, however, changes in the mesocolon in the form of fibrous thickenings, high-grade fat content and abnormal shortness. These changes cause such pressure and squeezing of the gastro-enterostomy loop that the comparatively weak motility possessed by this portion of the bowel cannot overcome the obstruction. After large resections the mesocolon may be pulled up so much that it compresses the loop of the gastro-enterostomy, likewise with obstruction to passage as a sequel. All these changes lead to stagnation in, as well as distension and paresis of, the afferent loop, which, when the distension reaches a certain point, obtains communication with the stomach. The functional state thus be-

comes the same as in primary distension-paresis, viz the stomach empties into the afferent loop, not into the efferent one. Hence, only when the mesocolon is fully normal is posterior gastro-enterostomy usable. When it is the seat of changes, anterior gastro-enterostomy ought to be performed.

Severe obstruction can undoubtedly be almost entirely avoided by a correct choice of the type of gastro-enterostomy.

In obstructions which arise after a few days' normal or satisfactory emptying inflammatory changes and adhesions about the gastro-enterostomy are the commonest cause. The feeble motor activity in the upper part of the small intestine is unable to overcome even comparatively slight obstructions of this kind.

The treatment of the short-lived obstructions to emptying consists of removing the stagnant contents of the stomach by repeated stomach washings or permanent suction as well as of parenteral administration of solutions of sodium chloride and glucose, possibly also blood transfusion. In the severe and long-standing obstructions due to distension-paresis, changes in the mesocolon and formation of adhesions, a jejunostomy is to be established for nutritional purposes. The obstruction is overcome spontaneously in the majority of cases within a not overlong space of time, and hence the operations designed to abolish or to get round the obstruction which are often extensive and combined with a high mortality, may very well be avoided.

### Zusammenfassung

Nach operativen Eingriffen am Magen wird dessen Funktion nicht selten gestört, manchmal mehr, manchmal weniger. Auch eine gewisse Darmparese ist Folge dieser Eingriffe, besonders der Gastroenterostomien. Nach GE und Magenresektion muss man deshalb darauf gefasst sein, einige wenige Tage lang durch Magen-Darmatonie bedingten Entleerungshindernissen zu begegnen.

Entleerungsschwierigkeiten, die über die durch die erwähnte Magen-Darmatonie bedingten hinausgehen, haben entweder direkte mechanische Gründe oder beruhen auf durch den operativen Eingriff bedingten Dehnungsparesen.

Bei Resektion nach Billroth I kann die durch die Vernahung der Resektionsflächen miteinander bedingte Dehnung der Magenwand eine Parese hervorrufen, die ernste Entleerungsschwie-

rigkeiten gibt. Da solch eine Dehnung bei grossen Resektionen und unter gewissen anderen Bedingungen nicht zu vermeiden ist, liegt hierin einer der vielen Gründe, die Verwendung dieser Resektionsform zu beschränken.

Bei antekolischer GE (mit oder ohne Resektion) mit langer Schlinge und EA zwischen den Schenkeln derselben, besteht die gewöhnliche Ursache eines Entleerungshindernisses darin, dass die GE-Schlinge zu kurz gewählt wurde, wodurch die zuführende Schlinge zu stark gedehnt und deswegen parietisch wird. In diese parietische Darmpartie, die bei GE ohne Resektion als nebensächlich anzusehen ist, bei gleichzeitiger Resektion hingegen als antiperistaltisch gerichteter Blindsack, entleert sich der Mageninhalt, und es findet keine oder doch ungenügende Entleerung in die abführende Schlinge statt. Um unter allen Umständen eine Dehnungsparese zu vermeiden, ist die Schlinge bei dieser Form von GE mindestens 50 cm lang (am kontrahierten Darm gemessen) zu wählen.

Bei hinterer GE mit oder ohne gleichzeitige Resektion, mit kurzer Schlinge vorgenommen, kann das Darmhindernis natürlich auch dadurch bedingt sein, dass die GE-Schlinge zu kurz gewählt wurde, so dass die Dehnung ausgesetzt und dadurch parietisch wird. Die gewöhnlichste Ursache des Entleerungshindernisses bei dieser Form von GE sind jedoch Veränderungen des Mesokolons in Form fibroser Verdickungen, hochgradigen Fettgehalts und abnormer Kurze. Diese Veränderungen führen zu so starkem Druck auf die GE-Schlinge und so starker Einschnürung derselben, dass die verhältnismässig schwache Motilität dieser Darmpartie das Hindernis nicht zu überwinden vermag. Bei grossen Resektionen kann das Mesokolon so stark hinaufgezogen werden, dass es die GE-Schlinge komprimiert, gleichfalls mit daraus folgendem Passagehindernis. Alle diese Veränderungen führen zu Stauung sowie Blähung und Parese der zuführenden Schlinge, die, wenn die Aufblähung einen gewissen Grad erreicht hat, mit dem Magen in Kommunikation tritt. Der funktionelle Zustand wird also der gleiche sein wie bei primärer Dehnungsparese, nämlich Entleerung des Mageninhalts in die zuführende, nicht in die abführende Schlinge. Hintere GE ist also nur bei völlig normalem Mesokolon verwendbar, bei Veränderungen desselben ist vordere GE vorzunehmen.

Schwere Entleerungshindernisse lassen sich durch richtige Wahl der GE-Form sicherlich fast völlig vermeiden.

Bei den nach einigen Tagen normaler oder doch befriedigender Entleerung auftretenden Entleerungshindernissen stellen entzündliche Veränderungen und Verwachsungen in der Umgebung der GE gewöhnlichsten Ursachen da. Die schwache Motilität in der oberen Partie des Dunndarmes vermag selbst verhältnismässig geringe Hindernisse dieser Art nicht zu überwinden.

Die Behandlung der kurz dauernden Entleerungshindernisse besteht in Entleerung des stagnierenden Mageninhalts durch wiederholte Magenspülungen oder permanente Absaugung sowie parenterale Zufuhr von NaCl- und Glukoselosung, evtl. Bluttransfusion. Bei den schweren und langdauernden Entleerungshindernissen durch Dehnungsparese, Mesokolonveränderungen und Verwachsungen wird zu Ernährungszwecken eine Jejunostomie angelegt. Das Entleerungshindernis wird in der Mehrzahl der Fälle nach nicht allzu langer Zeit spontan überwunden, so dass sich die oft grossen und mit hoher Mortalität einhergehenden Eingriffe, die die Behebung und das Umgehen des Hindernisses bezwecken, am besten vermieden werden.

### Résumé

Après les interventions opératoires sur l'estomac sa fonction motrice est souvent troublée, tantôt plus tantôt moins. Un certain degré de paralysie intestinale succède aussi à ces opérations et cela est surtout vrai de la gastroentérostomie. Après celle-ci et la résection gastrique, il faut donc s'attendre à une gêne à l'évacuation de l'organe pendant un ou deux jours, voire quelques jours de plus, du fait de l'atonie gastro-intestinale.

Lorsque cette gêne à l'évacuation dure trop longtemps pour qu'on puisse l'attribuer à la dite atonie gastro-intestinale, elle est due ou à une cause mécanique directe, ou à une paralysie secondaire à l'étirement des viscères pendant l'acte opératoire.

Dans la résection selon Billroth I l'étirement de la paroi stomacale qui résulte de la suture des tranches viscérales bout à bout peut donner lieu à une paralysie créant un sérieux obstacle à l'évacuation. Attendu que pareil étirement est inévitable dans les ablations larges, ainsi que dans d'autres circonstances encore, il y a là une raison, avec beaucoup d'autres, de restreindre l'usage de ce mode de résection gastrique.

Dans la gastroentérostomie antécôlique (avec ou sans résection), à anse longue et entéroanastomose complémentaire entre ses pieds,

la cause habituelle de l'obstacle c'est que l'anse a été prise trop courte, de sorte que sa moitié afférente est trop fortement tendue et en devient parétique. Le contenu de l'estomac se déverse dans ce segment intestinal parésie qui, dans la gastroentérostomie simple est à considérer comme un canal accouple latéralement, et dans celle avec résection forme un cul-de-sac à direction anti-péristaltique, et il ne se produit aucune évacuation, ou tout au plus une évacuation insuffisante, du côté efférent. Pour éviter en toute circonstance une paralysie par élongation il faut, dans cette forme de gastroentérostomie, prendre une anse longue d'au moins 50 centimètres, mesurés sur l'intestin contracté.

Dans la gastroentérostomie postérieure à anse courte, avec ou sans résection, la gêne à l'évacuation peut naturellement tenir de même à ce que l'anse de gastroentérostomie n'a pas été choisie assez longue, d'où étirement et paralysie. Cependant l'obstacle le plus ordinaire à la vidange réside dans des anomalies du mésocolon, sous forme d'épaississements fibreux, d'adiposité extrême ou de brièveté exceptionnelle. Ces anomalies entraînent tant de compression et d'étranglement de l'anse de gastroentérostomie que la péristaltique relativement faible de ce segment intestinal ne réussit pas à surmonter l'obstacle. Dans les grandes résections le mésocolon peut être si fortement attiré vers le haut qu'il comprime également l'anse de gastroentérostomie, d'où gêne apportée au passage. Tous ces facteurs entraînent une stagnation dans l'anse afférente avec distension et parésie, qui se communique à l'estomac lorsque la dilatation atteint un certain degré. Le résultat fonctionnel est alors le même que dans la paralysie due primitivement à l'étirement des viscères, à savoir l'évacuation de l'estomac dans l'anse afférents et non dans l'efférents. C'est donc uniquement lorsque le mésocolon est parfaitement normal que la gastroentérostomie postérieure est utilisable, quand il présente des altérations il faut exécuter la gastroentérostomie antérieure.

Il est certain qu'en choisissant judicieusement le type de gastroentérostomie on peut ainsi éviter presque entièrement les troubles sérieux de l'évacuation.

Lorsque les troubles apparaissent après quelques jours d'évacuation normale ou satisfaisante, ils sont habituellement causés par des lésions inflammatoires ou des adhérences qui se forment autour de la gastroentérostomie. La motilité de la partie supérieure de l'intestin grêle n'est pas capable de surmonter des obstacles de ce genre, même relativement légers.

Le traitement des troubles d'évacuation, peu prolongés consiste à vider l'estomac de son contenu stagnant par des lavages répétés, ou par l'aspiration continue associée à l'administration parentérale de solutions de NaCl et de glucose, avec éventuellement des transfusions sanguines. Dans les obstructions sévères et durables causées par la paralysie d'étirement, des altérations du mésocolon et des adhérences, on pratique une jejunostomie pour alimenter le malade. L'obstacle disparaît spontanément dans la plupart des cas avant trop longtemps, ce qui permet d'éviter d'une façon appropriée les interventions majeures et grevées d'une lourde mortalité qui visent à lever l'obstacle ou à le contourner.

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## Studien über purpuraähnliche Krankheiten der Harnwege.

(Auf 10 Fällen basierende klinisch-ätiologische Untersuchung)

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Die in die Harnwege lokalisierte Purpura ist seit langem bekannt NITZE und VIERTTEL wussten schon von der Blasenpurpura als möglichem Symptom von Blutkrankheiten und rheumatischer Peliose Doch beginnt, abgesehen von den Beobachtungen CAMELOTS 1911, die eigentliche Geschichte der Purpura der Harnwege erst 1913, als KIDD und BLUM getrennt die besonderen Krankheitsbilder, die Pathogenese und die ätiologischen Faktoren derartiger Fälle aufklärten Durch BLUM wurden diese Fälle unter dem Namen Blasenpurpura von dem nichtssagenden Begriff Cystitis haemorrhagica gesondert In den Jahren nach dem ersten Weltkrieg wurden solche Fälle im Schrifttum etwas zahlreicher mitgeteilt, u a von STEWENS und PETERS 1920 26 sichere und ausserdem 11 unsichere Fälle und von KIDD 1928 24 Fälle, während andere Veröffentlichungen über die Purpura der Harnwege im allgemeinen selten sind und sich auf wenige Fälle gründen So ist die Blasenpurpura als eine Rarität betrachtet worden, und zwar dermassen, dass sie in den gewöhnlichsten Lehrbüchern der Chirurgie keine spezielle Erwähnung gefunden hat Nach der Ansicht OTTOWS ist diese angenommene Seltenheit nur scheinbar und beruht darauf, dass die Fälle im allgemeinen bei Internisten in Behandlung kommen STEWENS und PETERS, die während 18 Monate ihr umfangreiches Material unter englisch-amerikanischen Soldaten in einem Etappenkrankenhaus in Frankreich

sammelten, fassen die grosse Zahl der von ihnen angetroffenen Fälle nicht als eine Folge der Kriegsverhältnisse auf und glauben auch nicht an die Seltenheit der Krankheit überhaupt. In einer früheren Veröffentlichung habe ich eine von den obigen abweichende Ansicht dargelegt. Die Tatsache, dass ich während 18 Monate in den Jahren 1942—43 im Krankenhaus des F. R. K. 10 Fällen begegnet bin, ohne dass meines Wissens früher überhaupt Fälle des gleichen Typus vorgekommen sind, zeigt meiner Meinung nach unwiderleglich, dass die Kriegsverhältnisse die Purpurafrequenz erhöhen durften. Jedenfalls verdient die Krankheit, mag sie in Friedenszeiten eine Seltenheit sein oder nicht, heutzutage wegen ihrer Häufigkeit Beachtung. Da sie sich überdies in der Mehrzahl der Fälle als für den Patienten sehr unangenehm und zugleich als therapieresistent erwiesen hat, ist ihre Kenntnis von Wichtigkeit.

### Klinisches Krankheitsbild

Nach der Beschreibung von BLUM beginnt die Blasenpurpura im allgemeinen plötzlich, sehr oft mit den Symptomen einer leichten akuten Erkältungsinfektion. Ziemlich unvermittelt bekommt der Patient darauf Harndrang und bemerkt eine Hamaturie. Im Harn finden sich dabei reichlich Erythrozyten, während die Leukozyten und Bakterien in der Regel fehlen. Zystoskopisch sieht man auf der Schleimhaut der Blase in diesem Anfangsstadium zahlreiche Petechien von wechselnder Grösse und Form, wogegen die Zwischenpartien normal aussehen und die Blase auch sonst noch keine nennenswerten Reizsymptome aufweist. Manche Fälle können auf diesem Stadium stehen bleiben (*Purpura simplex*), aber in den meisten Fällen konfluieren die Petechien zu grosseren Flecken und bedecken sich mit Fibrinmembranen. Das Krankheitsbild wird auf diese Weise weniger charakteristisch (*Cystitis membranacea*). Die Anfangshamaturie ist nach BLUM zumeist von terminalem Typus. In meinem Material war sie eine solche nur in 3 Fällen (1, 6 und 10). Eine reichliche diffuse Hamaturie trat in 4 Fällen auf, während das Blut in 3 Fällen (3, 4 und 7) nur mikroskopisch festgestellt werden konnte oder der Blutgehalt des Harnes dem Patienten entgangen ist. Während des ersten Monats nach Beginn des Krankheitsanfalls dominieren im Harnbefund die Erythrozyten, wogegen die Bakterien und die Leukozyten meistens vermisst wurden. Zystoskopisch ist alsdann die Fest-

stellung von Petechien leicht, während Fibrinbelage und -wolken entweder nicht oder relativ wenig vorhanden sind. Nur 3 Fälle (4, 7 und 8) vertraten in ihrer Entwicklung am ehesten den Simplex-Typus. In den späteren Stadien ist ein reichliches Vorkommen von Leukozyten und Fibrinbelagen vorherrschend. Die Blutungen hören auf oder treten periodisch auf, so dass der gewöhnlichste Harnbefund eine aseptische Pyurie ist, woneben ausserordentlich reichliche Fibrinwolken die zystoskopische Untersuchung stören und oft die sichere Feststellung von möglicherweise noch vorhandenen Petechien verhindern. In den Fällen, die ich in diesem Stadium, also mehr als einen Monat nach Beginn des Krankheitsanfalls untersucht habe, war der Nachweis von Petechien denn auch regelmässig so unsicher, dass die Diagnose auf Grund allein dessen nicht als sicher gelten konnte. In Fall 4 war sehr schon zu sehen, wie sich die Mitte der am dritten Krankheitstag konstatierten reinen Petechien 7 Tage später mit Fibrin bedeckt hatte, während die Petechien zu umfangreicheren Flecken konfluert waren, in deren einem das Zentrum ausserdem blasenformig erhöht war. Der subjektive Zustand ist wegen des die Patienten stark peinigenden Harndranges oft erheblich gestört, dies besonders in den Fällen, in denen man objektiv feststellen kann, dass die Kapazität der Blase reduziert ist. In schlimmsten Fällen (2, 3 und 9) betrug sie nur 30—60 ccm, und die Patienten befanden sich mit ihrem standigen Harnflaschenbedarf in einem geradezu bedauernswerten Zustand.

BLUMS Theorie darüber, wie auf das Cystitis membranacea-Stadium eine digestive Ulzerationsbildung (*Ulcus simplex pepticum*) folgt, ist nicht von allen Forschern gutgeheissen worden (KIDD). Bei mir war in 2 Fällen (2 und 6) in einem Stadium der Krankheit sehr undeutlich ein solitäres Ulkus zu bemerken, aber es ist möglich, dass solche unter Fibrinbelagen versteckt gewesen sind und nur einfach wegen der in diesem Stadium bestehenden grossen Zystoskopieschwierigkeiten nicht sicher konstatiert werden konnten.

Die Einteilung der Purpurafälle in 3 Schwereklassen nach KIDD (Purpura simplex, recurrens und fulminans) scheint mir nicht gelungen, da nur in einem meiner Fälle (9) ein Rezidiv aufgetreten ist und von den übrigen Fällen 6 wegen des Schweregrades nicht der Simplex-Gruppe zugerechnet werden können. Die Heilung fand in diesen zum typischen Cystitis membranacea-Stadium gelangten Fällen allmählich im Laufe von etwa  $\frac{1}{2}$  Jahr statt.

Die Frage, ob die seltene, zum Tode führende *Purpura fulminans* eine ganz besondere Krankheit oder eine eigenartige hamorrhagische Reaktion einer unbekannten Infektion ist, ist ausserdem vorläufig unentschieden (SCHULTZ)

Die Lokalisation der Purpurapetechien und der anderen Symptome in bestimmte Organe unterliegt ihren eigenen unbekannten Gesetzen. In den Fällen von *Purpura* der Harnwege scheinen verhältnismässig selten gleichzeitige Symptome in der Haut aufzutreten, in meinen Fällen keinmal. Doch ist es nicht ausgeschlossen, dass das Verhalten in Wirklichkeit ein anderes ist, da die meisten mit Hautsymptomen einhergehenden *Purpurae* in interne Behandlung kommen, sozusagen ausserhalb des Wirkungsbereichs des Zystoskops geraten. Die Lokalisation in den Harnwegen selbst kann auch zum mindesten ihrer Intensität nach variieren, so dass manche Forscher die renale Form von der eigentlichen Blasenpurpura unterscheiden. In den von KIDD und CLOSE beschriebenen Fällen war die Krankheit dabei schmerzlos, im Gegensatz zu der typischen vesikalen Form RUMFEL und PRÆTORIUS dagegen haben in ihren Fällen heftige Nierenkoliken beobachtet, und der letztgenannte hat die Symptomtrias reine Hamaturie, Nierenkolik und Fieber als typischen Anlass zum Purpuraverdacht aufgestellt. Zwei meiner Fälle (4 und 7) vertraten den renalen, schmerzhaften Typus, wobei der eine zugleich deutliche Blasensymptome aufwies. In dem letzteren Fall führte die Prætorius'sche Trias schon vor der zystoskopischen Untersuchung zu einer richtigen Wahrscheinlichkeitsdiagnose, und in dem anderen hatte sie es tun müssen. In dem Material von KIDD gehörte ein Drittel der Fälle dem renalen, schmerzlosen Typus an. Da er in 7 Fällen wegen grosser Blutungen eine Nephrektomie ausführte und dabei in der Pelvis typische Blutergüsse konstatieren konnte, lassen sich seine Befunde nicht in Frage stellen. Offenbar kann die renale *Purpura* mithin sowohl schmerzlos als auch Koliken verursachend auftreten. STEWENS und PETERS haben laut Angabe Petechien auch in der Urethra gefunden, und typische, hauptsächlich in die Harnblase lokalisierte Symptome kamen auch in zwei meiner Fälle vor (2 und 9). In Fall 9 floss gelber Eiter aus der Harnrohren, die Prostata war empfindlich und die Glans penis »entzündet und ulzerös«.

Auf das Vorkommen von Bakterien im Harn bei *Purpura* komme ich später bei der Besprechung der Ätiologie zurück. Von den gleichzeitigen anderen Symptomen verdienen das Fieber und die Gelenksymptome eine nähere Betrachtung. Das Fieber ist im all-

gemeinen ziemlich leicht und völlig atypisch und tritt gewöhnlich nur am Anfang der Krankheit auf. Arthritiden hat KIDD nur bei 2 seiner 24 Patienten beobachtet. Unter meinen Fällen kam viermal (3, 8, 9 und 10) eine recht schwere Polyarthrititis, zweimal sofort im Anfangsstadium der Krankheit vor. In Fall 3 kam sie vor den Blasensymptomen zur Heilung, während sie in Fall 8 bis zuletzt dauerte. In diesem letzteren Fall zeigte sich im Heilungsstadium der Blasensymptome ausserdem vorübergehend eine Iritis rheumatica. Die Senkungsreaktion der Erythrozyten war in den Fällen mit Arthritissymptomen umgekehrt wie in den meisten anderen Fällen bedeutend beschleunigt.

Ein langer anhaltender Blase reizzustand ruft offenbar allmählich pathologisch-anatomische Veränderungen in den Harnwegen hervor. In Fall 9 wurden schon während des ersten Anfalls vor 10 Jahren eine beiderseitige Hydronephrose und Hydroureter konstatiert, und während der letzten Krankheitsattacke konnte bei der Ausführung der parasakralen Sympathektomie festgestellt werden, wie die Ureteren fast daumendick und die Muskulatur ihrer Wand wie auch die der Blase mächtig hypertrophiert waren. Röntgenologisch ähnliche leichtere Veränderungen wurden in zwei Fällen (3 und 6) angetroffen. Die Entstehung einer Hydronephrose und eines Hydroureters auf solchem Boden ist meines Wissens früher nicht erwähnt worden.

### Ätiologie und Pathogenese.

Hinter dem subkutanen und submukösen multiple Blutergüsse aufweisenden, verhältnismässig einheitlichen Bild der Purpura verstecken sich verschiedenartige teils bekannte, teils unbekannte ätiologische Faktoren, die zur Entstehung typischer kapillarer Blutungen führen, die sich deutlich von Sugillationen und Hamatomen unterscheiden. Bekannte ätiologische Faktoren sind

- 1 Thrombozytopenie, die essentiell (Morbus maculosus Werlhofii) oder symptomatisch durch verschiedene Blut- oder Infektionskrankheiten provoziert sein kann. Bei Hamophilie, die klinisch sehr ähnlich ist, kommen keine spontanen Blutergüsse vor.

- 2 Hypovitaminosen des Skorbuttypus, primärer oder sekundärer Mangel des Faktors C oder P.

- 3 Septisch-rheumatoide, ihrem Wesen nach mehr oder weniger unbekannte Krankheitsprozesse (Purpura septica, Peliosis rheumatica).

- 4 Infektionskrankheiten mit purpuriformem Exanthem (Pocken, Typhus, Scharlach, Lues)
- 5 Verschiedenartige Toxikosen (Uramie, Ikterus, Phosphor- und Anilinvergiftungen usw.)

Ausserordentlich gross ist jedoch die Zahl der Purpurafälle, in denen auch eine genaue klinische Untersuchung keine Symptome für einen der genannten ätiologischen Faktoren ergibt OTTOW teilt die Blasenpurpurae auf Grund der Ätiologie in 3 Gruppen ein 1. Purpura vesicalis vera, Fälle in denen eine deutliche hamorrhagische Diathese besteht 2 Purpura vesicalis spuria, klinisch typische Fälle ohne manifeste hamorrhagische Diathese und ohne entzündliche Symptome 3 Cystitis purpuriformis, Fälle von Übergangsform, in denen die entzündlichen Symptome auffallend sind, also hamorrhagische, meist abakterielle Zystitiden, von denen jedoch manche nach ihm keine echten Purpurae sind Diese an sich klar scheinende Einteilung ist nicht auf die klinischen Fälle anwendbar Alle Fälle von Purpura der Harnwege haben eine Hamaturie entweder mit oder ohne bekannte Ursache, bei ihnen allen liegt mithin eine mehr oder weniger manifeste hamorrhagische Diathese vor, aber nur bei einem Teil der Fälle sind gleichzeitig spontane hamorrhagische Symptome auf der Haut oder in anderen Organen anzutreffen Der Nachweis der Diathese mit den gewöhnlichen Methoden im Blutbild, bei dem Rumpel-Leedeschen Versuch und durch andere Untersuchungen gelingt auch bei weitem nicht immer Nach SCHULTEN setzt der Begriff hamorrhagische Diathese eine Blutungsneigung im ganzen Organismus oder in umfangreichen Teilen desselben voraus, so dass man nur von einem Teil der urologischen Purpurafälle sagen kann, dass sie eine echte hamorrhagische Diathese haben Andererseits wird die hamorrhagische Diathese jedoch nur durch die Niedrigkeit des quantitativen Schwellenwertes von normaler Neigung zu Blutergüssen unterschieden Niedrige Thrombozytenwerte hatten in meinen Fällen nur 3 und nur einer in bemerkenswerterem Grade (8) Jedoch fiel der Rumpel-Leedesche Versuch gerade in diesem Fall nicht positiv aus, und bei der quantitativen Messung nach JERSILD zeigte sich die Kapillarresistenz da denn auch als ebenso gross wie bei gesunden Personen

Der Rumpel-Leedesche Versuch wurde nach SEYDERHJELM mit dem Blutdruckmesser ausgeführt, wobei ein Druck von 20 mm Hg über dem diastolischen Druck während 3 Minuten auf den Oberarm wirkte

Zahlreiche deutliche Petechien wurden als positiv gerechnet. In einigen Fällen wurde JERSILDS quantitative Bestimmung der Kapillarresistenz mit einem Glastrichter von 2 cm Durchmesser ausgeführt. Hierbei wirkte ein durch verschieden hohe Quecksilbersäulen verursachter Unterdruck 1 Minute lang auf die Haut der Ellenbeuge. Bei Kontrolluntersuchungen an gesunden Personen konnte in Übereinstimmung mit JERSILD festgestellt werden, dass erst ein negativer Druck von etwa 150—250 mm Hg in der Wirkungszeit von 1 Minute deutliche Petechien in dem Hautbereich unter dem Trichter hervorruft.

Da in diesem Fall 8 eine gleichzeitige Hamaturie und eine deutliche Thrombozytopenie (48,000) sowie dazu eine Polyarthritiden ohne auf der Haut nachweisbare Blutungsneigung vorhanden waren, darf es wohl als sicher gelten, dass die hamorrhagische Diathese in dem Fall nur in den Schleimhäuten der Harnwege manifest gewesen ist. Nach derselben Richtung deuten die Feststellungen hinsichtlich meiner anderen Fälle. Das Rumpel-Leedesche Phänomen war nur in 6 Fällen (3, 5, 6, 7, 9 und 10) deutlich positiv, und spontane subkutane Blutergüsse sind in meinen Fällen ebensowenig wie Melaena vorgekommen. Ebenso verhielt es sich in dem Material von STEWENS und PERERS, während 7 der 24 Fälle von KIDD gleichzeitig ausserhalb der Harnwege auftretende Hamorrhagien hatten. Diese augenscheinliche, ausschliesslich in die Harnwege lokalisierte hamorrhagische Diathese erhält ihre Erklärung auch nicht durch die bisweilen im Harn anzutreffenden Bakterien, denn in denen meiner Fälle, wo das Rumpel-Leedesche Phänomen während der Hamaturie negativ war, war der Harn aseptisch. Die auf die Blutungszeit und den Blutkalziumgehalt bezüglichen Untersuchungen haben in sämtlichen Fällen normale Ergebnisse gezeigt. Dagegen war die dreimal von mir mit der Methode von PLUM-DAM untersuchte Prothrombingerinnungszeit zweimal deutlich verlängert (2 und 3). In Fällen, in denen keine Störung der Gerinnungsfunktion zu beobachten ist, bezeichnet HANKE die Blutungsneigung als vaskular. Eine derartige Blutungsdiathese kommt nach ihm auf infektiös-toxischer oder skorbutischer Basis vor. In Fall 3 war jedoch gleichzeitig eine Störung der Gerinnungsfunktion, C-Hypovitaminose und das klinische Bild der Peliosis rheumatica vorhanden.

C-Hypovitaminose im Blut kam in allen denen meiner Fälle vor (2, 3 und 4), in denen eine Analyse ausgeführt wurde. In Fall 4 war der Mangel am grössten, in den anderen Fällen geringer, aber doch durchaus deutlich in Anbetracht der bis zu der Untersuchung gegebenen reichlichen Ascorbin- und Frischobstmedi-

kation Die in den meisten meiner Fälle konstatierte, auf die Anfangshämaturie folgende hartnäckige aseptische Pyurie spricht ausserdem aufs nachdrücklichste für C-Hypovitaminose auch in allen nicht analysierten Fällen, da eine hartnäckige Pyurie stets zu dem Verdacht auf Vitamin-C-Mangel berechtigt (MORAWITZ und REYHER) Der A- und B<sub>1</sub>-Vitamingehalt des Blutes wurde in denselben Fällen wie der C-Gehalt analysiert Die B<sub>1</sub>-Menge war in allen normal, der A-Gehalt dagegen zweimal (3 und 4) deutlich herabgesetzt Da die A-Hypovitaminose bekanntlich eine Abnahme in der Resistenz des epithelialen Gewebes verursacht, ist ihre Kausalität mit der Cystitis membranacea oder der Ulkusbildung nicht ganz undenkbar

Auf eine septisch-rheumatoide Ätiologie hinweisende arthritische Symptome kamen nur in 4 meiner Fälle vor KIDD hat auf Grund seiner umfassenden und vielseitigen Untersuchungen den Eindruck erhalten, dass die die Purpura der Harnwege auslösende Ursache meist eine infektiöse oder infektiös-toxische ist Als kraftigste Stütze seiner Ansicht betrachtet er die in seinen Fällen konstatierten Bakteriurien sowie die in den Zähnen, im Rachen oder Darmkanal gefundenen fokalen Streptokokkenherde, wobei er mit den aus diesen hergestellten Vakzinen zweimal ein Rezidiv der Purpurapetechien herbeiführen konnte Zahnwurzelentzündungen wurden bei 6 meiner Fälle konstatiert, darunter alle Fälle mit Arthritis Bei Fall 4 erschien im Harn eine vorübergehende Streptokokkenbakteriurie sofort nach der Beseitigung des Wurzelgranuloms Der in Fall 3 von dem Patienten selbst festgestellte »Tripper« durfte in Symptomen einer in die Harnrohre lokalisierten Purpura bestanden haben In Fall 7 lag die Kristensen-Gonoreaktion bei der Untersuchung an der Grenze des Positiven (+2), aber Gonokokken wurden nicht gefunden, und nichts in dem Fall wies auf eine gonorrhöische Ätiologie hin Eine gonorrhöische Allgemeininfektion kommt jedoch oft mit anscheinend sehr ähnlichen arthritischen Symptomen und Zeichen einer terminalen Hämaturie wie die Blasenpurpura vor, so dass es meiner Ansicht nach nicht unmöglich ist, dass die Gonorrhöie ebensogut wie die sogenannten septisch-rheumatoiden Faktoren überhaupt als Erreger des Symptomenkomplexes der Purpura der Harnwege in Betracht kommen konnte Dabei musste die Gonoreaktion jedoch offenbar positiv sein

Nur in einem meiner Fälle (5) trat im Harn ein stabiler Bakterienstamm (*B. coli*) auf Vorübergehend haben sich Gruppenkok-

ken oder Stäbchen in zwei Fällen, wahrscheinlich infolge häufig vorgenommener Katheterisation gezeigt. Ich bin mit BLUM davon überzeugt, dass die festgestellten Bakterien, abgesehen von der obenerwähnten Streptokokkenbakteriurie, nicht für die Entstehung oder Entwicklung der Krankheit von Bedeutung gewesen sind.

Nach der nachgewiesenen oder angenommenen Ätiologie verteilen sich meine Fälle entsprechend der folgenden Tabelle

Tabelle I.

	Fall Nr	1	2	3	4	5	6	7	8	9	10	Zusammen
Thrombopenie										1		1
C-Hypovitaminose		?	1	1	1	?	?	?	?	?	?	3 (10?)
Septisch-rheumatoide Faktoren				1	1			?	1	1	1	5 (6?)
Unbekannt		1				1	1	1				4

Aus der Tabelle wird als wichtiges Verhalten ersichtlich, wie die bekanntermassen die hamorrhagische Diathese hervorruhenden verschiedenen Faktoren speziell in den am genauesten untersuchten Fällen gleichzeitig auftreten: in Fall 3 C-Hypovitaminose + Arthritis, in Fall 4 C-Hypovitaminose + Streptokokkenfokalherd und in Fall 8 Thrombozytopenie + Arthritis + Iritis. Infolge hiervon muss man annehmen, dass die Pathogenese kompliziert ist. Einerseits wirken die Vitaminmangelzustände erhöhend auf die Disposition ein, und andererseits provozieren die septisch-rheumatoiden infektiösen Faktoren Krankheitsanfälle. Für Fall 8 genügt eine derartige Erklärung jedoch nicht als solche. Ist die Thrombozytopenie in Fall 8 essentiell oder nur ein gleichwertiges Symptom der Krankheit? Die Ätiologie der Thrombozytopenie ist ja nicht mit Sicherheit bekannt. Es ist jedoch nachgewiesen, dass die septisch-rheumatoiden Infektionen sie hervorrufen können. In dem fraglichen Fall schien die ausserordentlich reichliche Zahnkaries nebst den Wurzelgranulomen den Fokalherd der Polyarthritis und Iritis zu bilden. Die Unterernährung des Patienten, zu der sich wahrscheinlich Hypovitaminosen gesellten, war offenbar die Ursache der hamorrhagischen Diathese. Ob die Thrombozytopenie aus derselben fokalen Infektion entstanden sein sollte wie die Arthritis und die Iritis, einer Infektion, die ausserdem die Blasenpurpura provozierte, lässt sich nicht ausmachen. Jedenfalls ist die entgegengesetzte Erklärung, dass die Thrombozytopenie die Grundursache der hamorrhagischen Diathese wäre, nicht wahrscheinlich.

Für die von mir dargelegte kombinierte ätiologische Erklärung sprechen am deutlichsten die Beobachtungen über die Frequenz der Blasenpurpurafälle. Solche waren im Schrifttum während des letzten Weltkrieges und danach zahlreiche mitgeteilt (STEWENS und PETERS, FARAGO, PRALTORIUS, SZABO). Meine 10 Fälle sind Zivilpatienten aus Helsinki, und sie fanden sich innerhalb  $1\frac{1}{2}$  Jahre 1942—43. Alle drei auf den Vitamingehalt des Blutes analysierten Fälle hatten einen deutlichen C-Mangel und zwei von ihnen sogar eine A-Hypovitaminose. Da zu allem hinzu bekanntlich ätiologisch unklare aseptische Pyämien im ganzen Land bedeutend mehr als früher vorgekommen sind, scheint mir die Annahme durchaus motiviert, dass die kriegszeitlichen Verhältnisse, insbesondere die C-Hypovitaminosezustände, eine ätiologische Ursache darstellen, die für die in die Harnwege lokalisierten Krankheiten des Purpuratypus disponiert. In dieselbe Richtung deutet das von mir beobachtete Verhalten, dass die Purpurafälle in mehr als der Hälfte meiner Fälle im Spätwinter, im Januar bis April, angefangen haben. Ob die Frequenz der mit Hautsymptomen auftretenden Purpura während der Kriegszeit zugenommen hat, weiss ich nicht. In einem englischen Material hat DAVIS keine Zunahme feststellen können.

Andererseits wissen wir, dass Uramie und Ikterus als ätiologische Faktoren des Purpurasymptomenkomplexes hauptsächlich durch den gestörten Vitaminstoffwechsel wirken. Das führt auf den Gedanken, dass ähnliche Störungen des Vitaminstoffwechsels die Dispositionsgrundlage für die meisten Purpurae bilden, indem sie die Gerinnungsfunktion des Blutes oder die Kapillaresistenz herabsetzen. Ausser dem entstandenen, mehr oder weniger latenten Dispositionszustand ist ein provozierender Reizfaktor für den Ausbruch einer manifesten Purpura erforderlich. Da bestimmte Gifte, wie Anilin und Phosphor, auch bei anscheinend gesunden Menschen Purpura, auch Blasenpurpura (SCHEELE und STOLZE), provozieren können, muss der Ausbruch mithin wesentlich ausser durch den Grad der Disposition auch durch die Stärke und die Kapillaraffinität des Reizfaktors bedingt sein. So genügt bei einem Skorbutkranken schon eine kleine Erkältung zur Überschreitung des Schwellenwertes des Manifestwerdens, wogegen das Kapillargift in den sogenannten septisch-rheumatoiden Fällen besonders effektiv sein muss.

In bezug auf ihr Alter und Geschlecht sind meine Patienten meistens junge Männer gewesen.

## Diagnose

Aus meinen Fällen geht hervor, wie das Krankheitsbild der Purpura der Harnwege recht schwankend ist, was augenscheinlich gerade auf der jeweiligen Intensität der erwähnten verschiedenen ätiologischen Faktoren beruht. Nur in wenigen Fällen ist das Bild so charakteristisch, dass sogar eine Wahrscheinlichkeitsdiagnose ohne Zystoskopie möglich ist. Andererseits geht das typische zystoskopische Bild des Anfangsstadiums der Krankheit in den meisten Fällen verhältnismässig schnell in die Cystitis membranacea über, die trotz ihres typischen Gepräges nicht ohne ausschliessende Lowenstein- und Kristensen-Untersuchungen zu einer sicheren Diagnosestellung genügt. Selten kann man mithin die Diagnose der Purpura der Harnwege mit Sicherheit auf Grund der gewöhnlichen urologischen Untersuchungsmethoden stellen, und auch dann gründet sie sich meist auf die exakte Ausschlussung anderer, Hämaturie und aseptische Pyurie verursachender Krankheiten. Durch das Streben nach einer ätiologischen Diagnose erhält man dagegen in der Mehrzahl der Fälle eine Bestätigung der klinischen, mehr oder weniger unsicheren Diagnose. Der Nachweis einer Thrombozytopenie oder der positive Ausfall des regelrecht ausgeführten Rumpel-Leedeschen Versuches genügt zur Sicherstellung der Diagnose. Findet sich jedoch im Blute eine normale Menge Thrombozyten und ist der Rumpel-Leedesche Versuch negativ, so kann die von der diagnostisch-therapeutischen Ausraumung des Fokalherdes herrührende Bakteriurie zu einer Klärung der Diagnose führen, wie in meinem Fall 4. In meinen verschiedenen Fällen ist die Diagnose auf die in Tabelle II angegebenen Symptome und Untersuchungsergebnisse basiert.

Differentialdiagnostisch gab die Zystoskopie eine unbestreitbar sichere Antwort nur in 2 Fällen, in deren einem die Feststellung ausserdem durch die Thrombozytopenie bestätigt wurde. Der stark positive Rumpel-Leedesche Versuch entschied das Problem unwiderleglich dreimal, und ein schwacher positiver Resultat bestätigte die Diagnose dreimal, so dass die Diagnose nur in 2 Fällen (1 und 2) durch blossen Ausschluss erzielt war. Hatten alle Fälle systematisch sofort im Anfangsstadium der Krankheit untersucht werden können, so wären möglicherweise zahlreichere charakteristische Symptome zu finden gewesen.

Tabelle II.

Fall Nr	1	2	3	4	5	6	7	8	9	10
<i>Wahrscheinlichkeitsdiagnose</i>										
Hamaturie (im Anfangsstadium)	+	+	+	+	+	+	+	+	+	+
Hartnackige aseptische Pyurie (später)	+	+	+	—	+	+	±	±	+	+
Zystoskopisch deutliche Petechien	±	±	±	+	—	±	—	+	±	±
Zystoskopisch deutliche Cystitis membranacea	+	+	+	—	+	+	—	±	+	+
Gleichzeitige Arthritis	—	—	+	—	—	—	—	+	+	+
<i>Nachweis der hamorrhag Diathese</i>										
Thrombozytopenie	—	—	—	—	—	—	—	+	—	—
Rumpel Leedescher Versuch	—	—	++	—	—	+	+	—	++	++
<i>Ausschliessende Versuche</i>										
Lowensteins Tb Kultur	—	—	—	—	—	—	—	—	—	—
Kristensensche Gonoreaktion	—	—	—	—	—	—	±	—	—	—
Bakterien im Harn <sup>1</sup>	—	—	—	—	—	—	—	—	—	—

## Therapie

Die grosse Mehrzahl meiner Fälle hat sich den geprüften Behandlungsmethoden gegenüber mehr oder weniger resistent erwiesen. Das ist auch begreiflich, da die Therapie, wie überhaupt, auf eine exakte ätiologische Diagnose gegündet sein sollte und eine solche mit einigen Ausnahmen nicht zu Gebote gestanden hat. Der dunkle Begriff der hamorrhagischen Diathese lässt sich als Ganzes therapeutisch schwer beeinflussen. Doch muss man immer versuchen, die Therapie der festgestellten oder angenommenen Ätiologie entsprechend zu lenken, denn rein symptomatische Behandlung hilft meistens gar nicht.

BLUM fordert dazu auf, reichlich Soda zu verabreichen, damit die saure Digestion in der Cystitis membranacea-Phase keine Ulcerationen in der Schleimhaut der Blase bilde. Die von ihm und SZABO mitgeteilten guten Ergebnisse sind nachmals nicht bestätigt worden. Auch ich habe in keinem einzigen Fall eine günstige Wirkung von reichlichem, langedauerndem Sodagenuß zu konstatieren vermocht. Das pH des Harnes, das sich im allgemeinen hartnäckig um saure Werte herum hielt, schien sich durch die Soda überhaupt nicht viel zu verändern. Die in 2 Fällen (6 und 8) auf Anraten von Doz. A. VARTIAINEN gefütterten Soja-

<sup>1</sup> Fall 2 und 7 vorübergehend B. coli oder Staphylokokken  
 „ 4 „ Streptokokkenbakteriurie  
 „ 5 andauernd B. coli

bohnen, 200 g täglich, machten dagegen den Harn gegen Abend deutlich alkalisch, aber der Morgenharn war fast ausnahmslos eben so sauer wie früher, und sonst war im Krankheitsverlauf keine überzeugend günstige Wirkung zu beobachten.

Die Blutung nahm in meinen Fällen keinmal bedrohliche Ausmasse an, aber sie kann manchmal sehr reichlich sein. So war KIDD gezwungen, 7 Nephrektomien auszuführen, wobei er im Nierenbecken umfangreiche submuköse Blutergüsse konstatierte. Ausgiebige intravenöse Vitamin-C-Therapie musste in derartigen Fällen einen günstigen Einfluss ausüben, da die Mehrzahl der Fälle offenbar eine C-Hypovitaminose hat und da festgestellt worden ist, dass auf grosse Vitamin-C-Gaben nicht allein in Fällen von postinfektöser hamorrhagischer Diathese, sondern mitunter auch bei Schönlein-Hanochscher Krankheit, essentieller Thrombopenie und sogar bei Hamophilie eine Hamostase folgt (STEPP, DYCKERHOFF und PRETZSCH). Die roten Blutkörperchen verminderten sich und verschwanden in meinen Fällen im allgemeinen verhältnismässig bald aus dem Harn bei gegebener peroraler Ascorbin- und Lebertrankonzentratmedikation. Auf die Cystitis membranacea übte die Vitaminverabreichung ebensowenig wie die andere Therapie eine deutlich sichtbare Wirkung aus. Fraglich bleibt, ob grössere parenteral gegebene C- oder A-Vitaminosen gerade in der mit aseptischer Pyurie verbundenen Cystitis membranacea-Phase mehr Effekt gehabt hätten. Die Blutungen sollten vielleicht auch durch Vitamin-P- oder K-Präparate beeinflusst werden, während sich die aseptische Pyurie in einigen von meinen Fällen durch Citrin oder Kovitol auf keine Weise veränderte (2, 3 und 6). Trotz des Fehlens deutlich wahrnehmbarer Behandlungserfolge muss jedoch die C- und P-Vitaminmedikation bei Purpura der Harnwege indiziert sein, da die C-Hypovitaminose oder die hamorrhagische Diathese überhaupt meist die nächste feststellbare oder annehmbare Ätiologie sind.

KIDD richtet sein Hauptaugenmerk auf die Beseitigung der Fokalherde aus den Zähnen, dem Rachen und dem Verdauungskanal. Ausserdem hat er laut Angabe mit Erfolg Streptokokkenserum und -vakzine angewandt. Die Autovakzine der aus den ausgeräumten Fokalherden gezuchteten Streptokokken gaben bei ihm die besten Resultate. In sämtlichen Fällen meines Materials wurde nach einer Beseitigung der etwaigen Fokalherde gestrebt, die verdächtigen Zähne und Tonsillen wurden radikal behandelt. Die schnelle Heilung und die auf die Beseitigung des Zahngranu-

loms unmittelbar folgende Streptokokkenbakteriurie in Fall 4 sprechen für die Richtigkeit der angewandten Therapie. In den Fällen 7 und 8 schien die Extraktion der eiternden Zahnwurzeln desgleichen umwälzend auf den Verlauf der Krankheit einzuwirken, während von den Massnahmen in den anderen Fällen kein sichtbarer Nutzen zu konstatieren war.

Die symptomatische Therapie hat in meinen Fällen kaum irgendwelche Ergebnisse geliefert. Die Blasenspülungen und Instillationen mit verschiedenen Substanzen, die Antispasmodika und die physikalische Behandlung jeglicher Art haben die oft ausserst peinigenden subjektiven Beschwerden fast gar nicht gelindert. In den schwersten Fällen durfte die operative sympathische Denervation der Blase als symptomatische Massnahme in Frage kommen (PASSLER). Leider starb Fall 9, bei dem eine Resektion des N. praesacralis ausgeführt wurde, 6 Tage später an einer postoperativen Pneumonie. Die günstige Wirkung des Eingriffes auf die Entleerung der stark verdickten, in bezug auf ihre Kapazität bedeutend verengerten Blase war jedoch handgreiflich, denn das zuletzt 3 Wochen vor der Operation zu den Instillationen gebrauchte Gomenol war sofort nach dem Eingriff in dem Harn in grossen Tropfen zu sehen, obwohl es in der Zwischenzeit nicht aufgetreten war. Zugleich wurden die vor der Operation unausgesetzt belastigenden Tenesmen spärlicher.

### Kasuistik

Der Kurze wegen lege ich hier einen Bericht nur über die Fälle 4, 6, 8 und 9 vor, die am meisten charakteristisch waren. Ein Bericht über die Fälle 1—4 findet sich in meiner früheren Arbeit.

*Fall 4* 47jahr Diener, Helsinki

Vor 12 Jahren ein »Nierensteinanfall«, sonst gesund. Am 15. 8. 1942 erkrankte Pat. plötzlich mit Übelkeit, Kopfschmerzen, starken in das Skrotum ausstrahlenden Schmerzen in beiden Nierengegenden. Kam sofort in das FRK-Krankenhaus. Status: Allgemeinzustand zufriedenstellend, 4 Tage lang Fieber bis 38° C. Harnabsonderung anfangs reduziert, der Kopfschmerz dauerte an, und Pat. hatte Singultus. Ziemlich heftige Kolikschmerzen wechselten von der einen Seite zu der anderen. Harn: Erythr. ++ Leuk. + — Bakt. — Tb. — Zystoskopie: Kapazität der Blase 300 ccm, Schleimhaut überall voll von 1/2—1 1/2 cm Durchmesser, am meisten in der Gegend der Ureterenmündungen, sonst keine Injektion. Die Ureterenmündungen geschwollen, so dass

nur die dünnsten Katheter durch Drehen eingeführt werden können, wonach sie ungehindert hinaufgehen. Retrograde Pyelographie normal. 21. 8. Intravenöse Pyelographie normal. Es wurden 3 kariöse Zähne entfernt, an der Wurzel eines Zahnes ein grosses Granulom. Die Schmerzen hörten bald ganz auf. 24. 8. Zystoskopie. Im Zentrum mehrerer Blutergüsse sind Fibrinmembranen erschienen, in der Trigonomregion ein umfangreicherer Bluterguss, dessen Zentrum blasenformig erhöht ist. 28. 8. Fortgesetzt schmerzfrei, Harn Eryth + Leuk + Streptok.  $\times \times$  pH des Harnes 6,2—7,1. WR —, SR 5 mm/1 Std. Blutbild normal, Thromboz. 297.000. Blutungszeit 1,5 Min. Rumpel-Leedescher Versuch negativ. Vitaminbestimmung im Blute am 24. 8. (Dr. O. Helve) A 76,0 IE/100 ml, B<sub>1</sub> 9,1  $\gamma$ %, C 0,58 mg %, also A- und C-Werte niedrig im Vergleich zu den Werten gesunder Kontrollpersonen. Am 15. 9. Symptomlos, Harn 0. Therapie vom 24. 8. an Soda, Vitamin-A-, C- und D-Präparate und Sulfatiazol.

*Fall 6* 22-jähr. Versicherungsbeamtin, Helsinki

Früher Angina und dabei vorübergehende Gelenksanschwellungen. Vor 2 Monaten einige Tage »Blasenentzündung«. Erkrankte im Mai 1943, Harndrang und Brennen sowie fast ganz im Anfang terminale Hamaturie. Harnkontinenz erschwert. Leichte Rückenschmerzen. Patientin kam 2½ Monate später in das FRK-Krankenhaus. Status: Ziemlich blasse Asthenikerin, Temperatur während des ganzen Anstaltsaufenthaltes subfebril, 36,8—37,5° SR 24/1 Std. WR —, Sahli 66 %, Thromboz. 133.000, im Blutbild sonst nichts von der Norm Abweichendes, Blutungszeit 2 Min., Ca des Blutes 8 mg %, Prothrombingerinnungszeit (PLUM-DAM) 30 Sek. Gonoreaktion 0. Harn Alb + 5 %, Erythr +, Leuk ++, Bakt — (Im Terminalharn Erythr +++), Tb —, Lowenstein —. Zystoskopie: Kapazität der Blase 250 ccm, Schleimhaut leicht blutend, odematos, reichlich Fibrinwolken und -beläge. Retrograde Pyelographie und Zystographie: Obere Kontur der Blase ungleichmässig und steil (Rtg-Diagnose: Cystitis), sonst nichts Pathologisches. Rumpel-Leedescher Versuch deutlich positiv. JERSILDS Kapillarresistenzversuch: Bei 150 mm Hg Unterdruck Petechien (bei Gesunden 150—250 mm Hg). Im Laufe eines Monats verschwand die Hamaturie, ebenso das Eiweiss aus dem Harn, Leukozyten fortgesetzt zahlreich, Harnbeschwerden bedeutend weniger. Fokale Infektionsherde waren nicht zu finden. Das pH des Harnes blieb anfangs trotz Sodamedikation zwischen 5 und 6, später stieg es bei Verabreichung von täglich 200 g Sojabohnen abends auf 7,5 bis 8, zeigte aber morgens den früheren Stand. Als Therapie wurden ausser dem Erwähnten per os reichlich Lebertrankonzentrat, Ascorbin und B<sub>1</sub>-Vitamin gegeben. Nach 2monatigem Krankenhausaufenthalt war der Allgemeinzustand deutlich verbessert und die Harnbeschwerden fast ganz verschwunden, aber im Harn fanden sich andauernd Leukozyten und von Zeit zu Zeit auch Erythrozyten. Noch nach 2monatiger poliklinischer Behandlung war der Harnbefund ein ähnlicher, aber alle subjektiven Symptome waren verschwunden. Während einer Woche per os gegebene Citrin- und Folliculintherapie hatte keine Wirkung.

*Fall 8* 27jahr Geschäftsmann

Von Kind auf wegen chronischer Ohreiterung behandelt. Sonst im allgemeinen gesund. In den letzten Monaten abgemagert und mude. 2 Wochen vor der Aufnahme ins Krankenhaus, im Sept 1943, wurde plötzlich ohne bekannte Ursache der Harn blutig, und zugleich trat Anschwellung und Empfindlichkeit in den Fussgelenken auf. Heftiger Harndrang, keine Nierenkoliken. Status Mager, blass, mude. Mittelfüsse geschwollen. Gelenke bei Bewegungen empfindlich. Zähne ausserordentlich karnos, zahlreiche eiternde Wurzelstumpfe. Temp 36,9° WR —, SR 27/1 Std. Blutbild Thromboz 48,000, sonst normal. Blutungszeit 2 Min. Gonoreaktion 0. Blut-Ca 13,3 mg%. Harn, Alb —. Erythr ++ Leuk —. Bakt —. Lowenstein —. Zystoskopie Kapazität der Blase 300 ccm, in der Schleimhaut zahlreiche Petechien von 2–3 mm Durchmesser, im Halsteil etwas Fibrinflocken. Retrograde Pyelographie Normal. Rumpel-Leedescher Versuch negativ. JERSILDS Kapillarresistenzversuch. Petechien erschienen erst bei 200 mm Hg Unterdruck. Alle kariösen Zähne wurden extrahiert, an der Wurzel von zweien Granulombildung.

1 Woche später Thromboz 60,000, Harn Erythr ++ Leuk + Bakt —

2 Wochen später Thromboz 120,000, Harn Erythr + Leuk + Bakt —

4 Wochen später Thromboz 215,000, Harn Erythr — Leuk — Bakt —

Die Harnbeschwerden verschwanden im Laufe von 2 Wochen, die Gelenksymptome bestanden weiter, und 8 Tage nach der Ankunft im Krankenhaus erschien im einen Auge eine typische Iritis rheumatica, die dann im Laufe von 2 Wochen heilte. Gleichzeitig trat eine beiderseitige seröse Gonitis auf. Das pH des Harnes schwankte zwischen 6 und 7, nach Sojabohnenmedikation hielt es sich zwischen 7 und 7,5. Die anderweitige Therapie bestand in symptomatischen Mitteln, in reichlichen Vitaminpräparaten per os und Sahcyl. Nach einem Monat war der Allgemeinzustand bedeutend gebessert, die Harnwegs symptomlos, die Gelenkbeschwerden waren erheblich vermindert, und Patient in poliklinische Behandlung über.

*Fall 9* 29jahr Lagergehilfe, Helsinki

Früher oft Angina. Im Sept 1933 erkrankte Patient zum ersten Male. Der Harn wurde blutig, Schmerzen in der Blasengegend, periodisch rezidivierende Gelenkbeschwerden. Diagnose damals Pyelitis et hydro-nephrosis bilat., calculosis renis et ureteris bilat. Bakterien waren nicht im Harn zu finden, die Kapazität der Blase betrug 100 ccm. Die Diagnose Calculosis beruhte nur auf einer Annahme. Im Laufe von 3 Monaten wurde Patient geheilt. Gelenkbeschwerden traten dann von Zeit zu Zeit auf. 1935 wurde Patient auf der dermatologischen Abteilung wegen »Trippers« mit Artigon behandelt. Hiernach zeitweise leichte Harnbeschwerden. Im Dez 1940 kam aus der Harnrohre eitriger Fluss, in dem der behandelnde Arzt keine Tripperbakterien fand. Im Jan

1941 kam Pat wegen eines Hamaturienanfalls wieder in das Krankenhaus. Die Diagnose lautete Pyelocystitis chl., hydronephrosis<sup>2</sup> l. a., lithiasis<sup>2</sup>. Damals bestanden heftige Harnbeschwerden, es traten mehrere reichliche Blutungen auf, aus der Urethra kam gelber Eiter, und die Glans penis war entzündet und ulzerös. Es wurde zuerst ein Prostatastein vermutet, aber ein solcher fand sich nicht. Bei der Zystoskopie betrug die Kapazität der Blase 50 ccm, die Wand der Blase war injiziert und »runzelig«, reichlich Fibrinbeläge, keine Ulcerationen. Nach ausserst schweren Stadien heilte die Krankheit auch diesmal im Laufe von 3 Monaten allmählich. Während dieser Krankheitsattacke blutete das Zahnfleisch von Zeit zu Zeit stark. Ende 1942 rezidierte die Gingivitis, im Jan. 1943 begann wieder aus der Harnröhre weisser Eiter zu kommen, und nach einem Monat verschlimmerten sich die Harnbeschwerden, der Harn wurde blutig, und mit ihm gingen grosse »lederähnliche« Stücke ab. Nachdem die Krankheit ausserst schmerzhaft 3 Monate gedauert hatte, kam Pat in das FRK-Krankenhaus. Status: Allgemeinzustand schlecht. Pat findet vor dem Harnbang und den brennenden Schmerzen Tag und Nacht keine Ruhe. An den Zähnen reichlich Karies und eiternde Wurzelstumpfe. Leichte Empfindlichkeit bei der Blase. Prostata etwas empfindlich, auf Druck kein Sekret aus der Urethra. WR —, SR 61/1 Std Temp 36°—37° Blutbild: Thromboz 352,000, Leuk 16,100, sonst normal. Blutungszeit 3 Minuten, Gonoreaktion 0, RN 49.5 mg%. Harn Alb +— Eryth + Leuk ++ Bakt — Lowenstein — Zystoskopie: Kapazität 125 ccm, Schleimhaut gerötet, »runzelig«, stellenweise fibrinbedeckt, Ureteroöffnung nicht zu finden, keine Konkrementen und keine Ulcerationen zu sehen. Wegen der lebhaften Blutung und reichlicher Fibrinwolken ist die Untersuchung sehr schwierig. Intravenöse Pyelographie: Hydronephrosis et hydroureter bilat. Rumpel-Leedescher Versuch stark positiv. Als Therapie reichlich Vitaminpräparate sowie Soda per os. Das pH hielt sich trotzdem hartnäckig zwischen 6 und 6.5. Die Behandlung der Zahneiterungen war ebenfalls nicht von Wirkung, im Gegenteil verschlechterte sich der Zustand allmählich immer mehr. Darum wurde nach einmonatiger Krankenhausbehandlung, also nachdem der Anfall etwa 4 Monate gedauert hatte, eine Sympathicectomy praesacralis per laparotomiam ausgeführt. Bei der Operation wurde konstatiert, wie die Ureteren daumendick erweitert und ihre Wand wie auch die der Blase dick waren. Am Abend des Operationstages und am folgenden Tag im Harn zahlreiche braune Öltropfen, offenbar Gomenol, das zuletzt 3 Wochen vor der Operation in die Blase instilliert war. Die Temperaturen waren leichter, aber Pat hatte hohes Fieber und war sehr müde. RN 26.1. Es wurde Pneumonie in beiden Lungen festgestellt, und Pat starb 6 Tage nach der Operation.

### Zusammenfassung.

Während 1½ Jahre 1942—43 habe ich 10 Fälle von Purpura der Harnwege angetroffen. Für das klinische Krankheitsbild sind cha-

rakteristisch gewesen 1 eine mehr oder weniger reichliche Anfangshamaturie und 2 eine darauf folgende, Wochen und sogar Monate anhaltende, beachtliche Blasenreizsymptome zeigende aseptische Pyurie an die sich eine reichliche Fibrinsekretion, eine sogenannte Cystitis membranacea, anschloss. Der zystoskopische Befund ist nur während der Anfangshamaturie klar und typisch. In der Cystitis membranacea-Phase gibt die Inspektion keine diagnostische Sicherheit. Von den Fällen vertreten 3 den Purpura simplex-Typus mit schneller Heilung, 6 waren schwere, bis ein halbes Jahr dauernde Krankheitsformen, und 1 rezidierte dreimal während 10 Jahre und starb zuletzt an einer postoperativen Pneumonie. Zwei Fälle gehörten hauptsächlich dem renalen, schmerzhaften Typus an, und 2 Fälle hatten Symptome einer Verbreitung des Krankheitsprozesses in die Urethra. Eine gleichzeitige Polyarthritis hatten 1 meiner Fälle, bei einem bestand ausserdem eine rheumatische Iritis. Die die hamorrhagische Diathese hervorruhenden verschiedenen ätiologischen Faktoren, Thrombozytopenie, C-Hypovitaminose und septisch-rheumatoide Infektionen traten oft zu gleicher Zeit auf. Im Hinblick hierauf muss die Pathogenese kompliziert sein derart, dass einerseits die Disposition steigernde Faktoren und andererseits manifeste Krankheitsanfälle provozierende Faktoren wirksam sind. Aus der die Dispositionen erhöhenden Wirkung der Vitaminmangelzustände erklärt sich am besten die offensichtliche Frequenzzunahme dieser Fälle in Kriegzeiten oder unmittelbar nach ihnen. Die Diagnose klärt sich selten mittels der gewöhnlichen urologischen Untersuchungsmethoden. Die Blutanalyse und der Nachweis der hamorrhagischen Diathese durch den Rumpel-Leedeschen Versuch stellen in den meisten Fällen die klinische Diagnose sicher, während sie gleichzeitig ätiologische Klärung geben können. Das Gelingen der Therapie hängt wesentlich von der ätiologischen Diagnose ab, die jedoch meistens unklar ist. C-Vitaminpräparate, in grossen Dosen parenteral angewandt, durften von Effekt auf die Blutungsneigung sein, während in der Cystitis membranacea-Phase die gegebene Vitaminmedikation keine Zeichen eines therapeutischen Effektes erkennen liess. Auf die Entfernung der fokalen Infektionsherde schien in einigen meiner Fälle eine günstige Wendung im Krankheitsverlauf zu folgen. Symptomatisch durfte in den schwersten Fällen eine sympathische Denervation der Blase berechtigt sein.

### Summary.

Report of 10 cases of purpura of the urinary tract who came under the author's own observation during a period of 18 months in the course of the years 1942 and 1943. The clinical picture of the disease was characterized 1) by a more or less copious hæmaturia at the initial stage of the disease and 2) by an aseptic pyuria giving appreciable symptoms of an irritation of the urinary bladder and which persisted for weeks and in some cases even for months. This condition was followed by a copious secretion of fibrin, a so-called cystitis membranacea. The cystoscopic findings were reliable and typical of the disease at the initial stage only, during the hæmaturia. During the stage of cystitis membranacea investigation did not permit of a definite diagnosis. 3 cases were of the purpura simplex type and were quickly cured, in 6 the disease assumed a severe character and persisted for as long as six months, in 1 case there were three relapses during a period covering ten years. This individual died finally of a post-operative pneumonia. 2 cases essentially represented the renal, painful type and 2 cases exhibited symptoms suggesting a spread of the disease into the urethra. In 4 cases polyarthritis coexisted and 1 case exhibited in addition rheumatic iritis. The different etiologic factors such as thrombocythopenia, C-hypovitaminosis and septic-rheumatic infections causing hæmorrhagic diathesis frequently occurred simultaneously. Considering this fact, it must be assumed that the pathogenesis of the disease is of a complex nature inasmuch as in addition to factors inducing increase of diathesis there must be factors at work causing a manifest flare-up of the disease. The obviously increased frequency of cases of this type during and immediately after times of war is feasibly explained by the fact that deficiency in vitamins increases the disposition to this disease. The urologic routine methods of examination permit of definite diagnosis in very rare cases only. In the majority of the cases the clinical diagnosis will be verified by blood analysis and by the evidence of a hæmorrhagic diathesis by means of Rumpel-Leede's test which both may also be helpful towards clarifying the etiology of the disease. Therapeutic success depends chiefly on the recognition of the etiology of the disease, which, however, is mostly obscure. Vitamin C preparations administered parenterally in large doses seemed to have an effect on the hæ-

temps de guerre, et immédiatement après. Il est rare que le diagnostic s'éclaire par les examens urologiques ordinaires. L'analyse du sang et la mise en évidence de la diathèse hémorragique par l'épreuve de Rumpel-Leede assurent dans la plupart des cas le diagnostic clinique, et peuvent en même temps donner des éclaircissements étiologiques. Le succès du traitement dépend essentiellement du diagnostic causal, lequel reste cependant peu clair la plupart du temps. Des préparations de Vitamine C administrées à hautes doses par voie parentérale ont sans doute une action sur la tendance aux hémorragies, tandis qu'au stade de cystite membraneuse la médication vitaminique n'a aucun effet thérapeutique reconnaissable.

Dans certains de mes cas l'éradication des foyers infectieux («infection focale»), sembla être suivie d'un changement favorable dans l'évolution de la maladie. Comme traitement symptomatique on peut admettre que dans les cas les plus graves l'extirpation des nerfs sympathiques de la vésie serait justifiée.

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## Stabilizing Operation for Asymmetrical Sacralization.

By

KNUD ELLIBTER PETERSEN

Among the numerous anatomic variations occurring at the transition between the lumbar column and the sacrum, the sacralization of the 5' lumbar vertebra, or lumbalization of the 1' sacral segment is one of the phenomena most often encountered in the clinic. In the last three decades a very comprehensive literature on the subject has been published, including the most conflicting views as to the frequency of this abnormality, its significance to the appearance of lumbosacral pains and its proper treatment. Whether the lesion consists in sacralization of the 5' lumbar vertebra or lumbalization of the 1' sacral segment is of no importance practically, but merely of theoretical phylogenetic interest. In the following, therefore, for practical reasons both forms will be mentioned as sacralization.

As to the frequency of sacralization the statements vary exceedingly. Thus JUNGHAAS mentions that in collective statistics the figures for the incidence of the affection vary from 0.6 % to 25 %. In the Scandinavian countries this subject has been dealt with in particular by INGEBLIGSEN who holds that the high figures for the incidence (over 5—6 %) are of minor interest as they must be due to an extension of the concept of sacralization that cannot be looked upon as justified. There must be an osseous or articular contact between the transverse of the 5' lumbar vertebra and the sacrum or the iliac bone, whereas ordinary hypertrophy of this transverse process, which is a very common phenomenon, cannot be designated as sacralization.

The significance of sacralization to the appearance of lumbosacral pains has likewise been discussed lively. It is a fact recognized by all authors that in many cases this deformity gives no symptoms whatever, and several authors (e. g., SCHULLER and MOUCHER, cited after INGEBRIGTSEN) have completely underestimated the clinical significance of sacralization. It seems to be the general view, however, that sacralization in many cases is the real cause of pains resembling lumbago and sciatica — a view that is corroborated by the favourable results from operative treatment. Furthermore, experiences appear to show that the pains most often are brought about by asymmetrical sacralization, whereas the symmetrical form of the lesion gives symptoms but seldom. In this connection it is to be mentioned that asymmetrical sacralization need not necessarily mean unilateral sacralization. It also applies to a bilateral lesion with osseous union on one side and articular contact on the other (cf. our Case 3).

The pains are generally attributed to the static changes: scoliosis, muscular contracture and, sometimes, arthritic changes in the nearthrosis. Previously the assumption has been advanced that the pain might be due to compression of the posterior branch of the 5' lumbar nerve, which passes between the transverse process of the 5' lumbar vertebra and the sacrum. Now, however, this view probably has to be given up. Skeletal studies (INGEBRIGTSEN) have not been able to lend any support to this theory. Sacralization seldom is associated with paresis, atrophy or disturbances of the sensibility, and, furthermore, this theory is disproved by the good results obtained by operative fixation.

Here we shall not enter further into these aspects of the lesion. The subject has been discussed at the Surgical Congress in Gothenburg, 1937, and no new points of view concerning the pathology of sacralization have been advanced since.

As to the treatment, it now appears to be agreed generally that most cases of symptom-giving sacralization may be managed successfully with conservative physiologic treatment, if necessary with employment of a supporting corset. Further, it seems to be agreed that cases occur not infrequently in which the conservative treatment fails, and in which the patients become disabled by the lesion so that operative treatment is indicated. But when it comes to the method for the operative treatment the general concordance of opinions ceases, two opposite views asserting themselves. One group of authors consider it most ra-

tional to perform a loosening operation in the form of resection of the sacralized transversal process, whereas the other group emphasizes the advantages derived from a stabilizing operation.

It appears as if resection of the sacralized transversal process is the operation most frequently employed. The total number of cases treated operatively in this way and reported in the literature up to 1939 is estimated by BROILLD to exceed 100. In the Scandinavian literature, particularly INGEBRIGTSEN has advocated this form of operation. In 1937 he reported 9 cases given such treatment. Here in Denmark, BARTELS (1939) has reported 4 cases given the treatment. The operative results on the whole appear to have been good. Still, this treatment seems to be liable to certain objections.

In the first place, the operation is rather difficult technically. The surgeon is working at a great depth, where a survey of the field makes it difficult, and from the cases reported it is evident that inconvenient hemorrhage often occurs. It is no wonder, therefore, that cases have been reported in which the operation had to be discontinued on account of such technical difficulties, without the resection being performed. This happened also in the case of one of our patients (Case 5), in which resection has been attempted previously in another hospital. Also INGEBRIGTSEN and SILVERSKIOLD mention similar cases.

In the next place it seems reasonable a priori to expect a tendency to reproduction of the sacralization because of the capacity of the osseous tissue for regeneration, and the relatively small size of the bone resected. Indeed, cases of this kind have been reported too (BROFELDT, GRAF, INGEBRIGTSEN).

Finally, this operation involves a risk of nervous injury. On its way down to the sciatic trunk, the anterior branch of the 5' lumbar nerve passes the transversal process of the 5' lumbar vertebra and is here exposed to traumatic injury. Indeed such injuries have been described (INGEBRIGTSEN, BARTELS, PASSETT, cited after WENZL).

In contrast to this loosening operation, also stabilizing operations have been suggested. Thus, in 1929, HIBBS & SWIFT reported the cases of 32 patients treated with ankylosing operation ad modum HIBBS. Of these patients 24 recovered completely, and 6 improved. Also Albee's operation has been employed repeatedly. Among others, INGEBRIGTSEN recommends this operation on elderly patients. GUILDAL finds that the operation ad

modum HIBBS offers certain advantages because the fixation of the bridge to the sacrum is unreliable, and there is a considerable risk of penetrating the thin bone on the posterior aspect of the sacrum. In four patients, on whom he performed the Hibbs operation, he also asserted some osseous tissue between the processus costarius and the sacrum for the sake of fusion. A similar fixative operation has been performed by SEMB.

In the following, mention is made of a stabilizing operation employed in this hospital. The method was given by BENTZON and has not been mentioned previously as an operation for sacralization. The same operative method has been employed, however, in several cases of spondylolisthesis and as such it was mentioned briefly by BENTZON in 1937, and by PRIP BUUS in 1942.

The method of fixation was preferred partly because of the above-mentioned objection to the resection, partly from general orthopedic considerations. When it is a question of freeing the patient from a painful affection in which the pain presumably is due to static anomalies, fixation will always be preferable to loosening, and the effect of a fixative operation is considerably easier to calculate than that of a loosening operation. Of course, a fixative operation may be contraindicated by the wish to preserve a mobility of functional importance, but such considerations do not hold good in these patients. Furthermore it is well-known practical experience that several sacralization patients may be rendered free from symptoms simply by giving them a corset — which also indicates that the fixative operation involves a correct principle.

### Technique.

The operation is carried out by transplantation of a fairly long tibial bridge which connects the posterior part of the iliac crest on both sides with the junction between the spinous processes of the 4' and 5' lumbar vertebrae. A transversal, upward convex, arcuate incision is made between the posterior superior iliac spines. The transverse processes of the 4' and 5' lumbar vertebrae, and a hole is made deeply in the interspinous ligament, which otherwise is spared. Then the iliac crest is laid bare round the posterior superior iliac spine on both sides, and, with a blunt probe, a tunnel is formed through the erector spinae so that the three points — the posterior superior iliac spines and the hole between the spinous processes of the 4' and 5' lumbar vertebrae

— as far as possible lie in a straight line Grooves are chisled in the crest for accomodation of the transplant, and the interval between the spinous processess is widened somewhat above and below, by means of a rongeur

Now a lead model is made, which is inserted precisely in the bed of the transplant and further formed to fit properly This lead model is then taken out again and used for the precise excision of the transplant from the anterior aspect of the tibia, corresponding in form and size to the model The transplant is excised by means of Albee's electrical saw Then the transplant is applied to its preformed bed and further fixed by means of a fascia-periosteal suture, followed by a skin suture

The patient is then placed in a plaster cast that has been prepared beforehand, and in which he is kept lying for about two months after the operation, whereafter he may be discharged with a plaster corset, which usually can be removed after one month

This operation has the advantage of being easy to perform It is relatively superficial, and it involves no risk of nervous injury

Five patients have been operated after this method, and it will be appropriate to give a brief abstract of their case histories

### Case Records.

*Case 1* Female, 15 years old (Reg No B 8009)

Past history of essential good health On  $15/_{11}$  39 the patient applied to the clinic on account of pain over the loins which had persisted for about 6 years, and was attributed to a minor traumatic injury Physical examination showed a slight sinistroconvex scoliosis of the lumbar column, with a suggestion of torsion prominence Otherwise no abnormality Roentgenography revealed sacralization of the right side, where the fan-shaped transverse process was seen to be in contact with the iliac crest as well as with the lateral mass of the sacrum, and this contact appeared to be osseous

As the symptoms presented by the patient were judged not to be particularly severe, it was found reasonable to keep her under observation for some length of time A little over one year later ( $10/_{1}$  41) she returned to the clinic The pain over the loins persisted, and for this reason she had to quit her job as housemaid The examination gave the same findings as previously This time the patient was equipped with a supporting fabric corset — to see if it might be of any benefit to her But it was not particularly effective and about a year later she returned to the clinic She was still completely unable to work on account of the pain over the loins, which was most pronounced on

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*Case 3* Male, 21 years old (Reg No B 15538)

Past history of good health On  $16/10$  42 the patient applied to the clinic on account of pain over the loins. The pain had then persisted for 9—10 months and had for long periods made him unable to work as automechanic. He had been admitted for about one month to another hospital where he had been given physiurgic treatment with merely transitory benefit. Physical examination showed a slightly increased kyphosis of the lower thoracic column, on compression of the trochanters the patient complained of pain corresponding to the posterior inferior iliac spine. No other abnormalities were found. X-ray examination showed asymmetrical bilateral sacralization complete synostosis with the lateral mass of the sacrum on the left side, while on the right side the connection appeared as a horizontal articular line. As the patient was disabled by his affection, after injection of novocain into the sites of the sacralization, which gave some relief from the pain, operative treatment was decided on.

On  $5/11$  42, *osteoplastic operation for sacralization* was performed in the usual way, the postoperative course was uncomplicated and the patient was discharged a little over two months after the operation, provided with a plaster corset which was removed six weeks later.

Half a year after the operation the patient returned for control examination. He had now resumed work and was perfectly symptom-free. About a year after the operation, of his own accord the patient sent us a letter in which he thanked for the operation and expressed his happiness over the result of this treatment. He is now perfectly free from symptoms and fully capable of work. In the meantime he has been summoned for auxiliary police service, which he has been able to stand well.

*Case 4* Female, 20 years old (Reg No B 15951)

On  $30/11$  42 the patient applied to the clinic on account of pain in the right lumbar region. The pain had then persisted for about four years, with considerable aggravation during the past year, so that she had been quite unable to work as housemaid the past six months. Physical examination revealed no particular abnormality of the vertebral column except for tenderness in the right lumbar region. X-ray examination showed typical sacralization of the 5' lumbar vertebra on the right side with a horizontal articular line between the lateral mass of the sacrum and the right transverse process. No abnormality was seen on the left side.

The patient was first given a supporting fabric corset, but this was ineffective. Three months later she was admitted to the hospital and on  $11/3$  43 *osteoplastic operation for sacralization* was performed in the usual manner. The postoperative course was uncomplicated, and about two months after the operation the patient was discharged with a plaster corset which was removed five weeks later and then the patient was given a supporting fabric corset.

Half a year after the operation the patient returned for control examination. She still complained of pain over the right loin and in



Fig 1 X-ray picture of patient No 3, six weeks after the operation, showing bilateral sacralization — articulation on the right side, osseous on the left

The transplanted bridge is seen in situ, between the two posterior superior iliac spines



the right lower extremity, but now the pain was not so intense as prior to the operation. The patient had previously been instructress in gymnastics, and it was our impression that she had been too energetic after her discharge. This was explained to her and she was told to let her physical training proceed more gradually.

About a year after the operation the patient returned again. She still complained of the same pain and, apart from light housework, she had not been able to do anything. X-ray examination showed that the bridge had fractured about in the middle and at its attachment to the iliac crest. She was therefore given a plaster corset, which was removed six weeks later. On X-ray examination there now seemed to be a tendency to healing of the fractures as there was a distinct callus formation. The patient was then provided with a supporting fabric corset. Now she is symptom-free when she wears this corset. She is still under observation.

*Case 5* Female, aged 31 years (Reg No B 16220)

For about 10 years the patient has been troubled with pain in her back, localized to the left lumbar region and radiating down to the hip region and down into the thigh. Four years previously, in another hospital, she was submitted to Albee's operation on account of sacralization on the left side, but this gave her no particular relief. About nine months ago, in another hospital (not the same as before), an attempt was made to resect the sacralized transverse process. This operation had to be given up, however, on account of technical difficulties. Since the last operation the patient has had paresthesias of the left leg, and the muscular power of the calf has been impaired a little.

On  $15/1$ , 43, she applied to this clinic because she still was troubled with the pain in her back in such a degree that she was unable to do her work as housekeeper. On physical examination the scars after the previous operations were conspicuous. The vertebral column was straight. Intense tenderness was referred to the angle between the iliac crest and the erector spinae on the left side. Movements could be carried out almost maximally but only with great cautiousness. X-ray examination showed that a rather extensive Albee's operation had been performed, the bridge extending from the second lumbar vertebra to the second sacral segment. Besides, shadows of contrast substance were seen in the dural sac. On the left side a piece of the transverse process of the 5' lumbar vertebra was seen to have been removed without making any difference in the completely osseous sacralization.

As the patient still was greatly inconvenienced by her affection, on  $4/3$ , 43 *osteoplastic operation for sacralization* was performed in the usual way. The postoperative course was uncomplicated, and the patient was discharged a couple of months after the operation, provided with a plaster corset which was removed one month later, whereafter she was provided with a supporting fabric corset.

About one year after the operation the patient returned for control examination. She now said she was feeling considerably better, although

she was not quite free from pain. On examination the spinal column was found to be somewhat flattened, and there was slight tenderness of the angle between the left erector spinae and the iliac crest. She was capable almost of maximal movements but performed them very cautiously. X-ray examination showed the bridge in good position.

### Discussion.

In the first three cases the operative result may simply be characterized as fully satisfactory. These three patients are all free from symptoms, they are able to work, and they are thankful for the result obtained. In Case 5 the result is hardly so good. In this case, however, it has to be taken into consideration that owing to the two previous operations and repeated hospitalizations this patient was a poor operative object. While, of course, we realized this beforehand and did not venture to entertain any great expectations from an additional operation, we still thought we ought to offer her the chance of such treatment as we could see no other way of helping her. One year after the operation, indeed, her condition is considerably better than before, although she is not symptom-free.

As to Case 4, on the other hand, the result is absolutely unsatisfactory. Even one year after the operation her symptoms remain unchanged. As mentioned above, this patient is a very energetic woman who evidently has been too eager to get to work again, notwithstanding our admonitions about proceeding cautiously. Thus fractures of the bridge have been the result. It may be that the bridge has been somewhat thin. On the last examination, after immobilization by plaster corset for six weeks, the fractures appear to show a tendency to healing. While thus the final result of the operation cannot be estimated yet, it seems reasonable to expect that the patient may become free from symptoms once the fractures of the bridge have healed. This case is rather instructive insofar as it illustrates that the mobilization ought to proceed at a slow and cautious rate, and that the operator ought to see that the bridge employed is sufficiently strong.

In keeping with the prevailing view the indications for this form of operative treatment have been very narrow and strict. Operation has been performed only when it was our impression that the affection disabled the patient and was not amenable to conservative treatment. Thus it may be emphasized that the total number of cases of sacralization examined or treated during

the  $7\frac{1}{2}$  years since this hospital was opened has been 66 — and of this total, then, operative treatment was found to be indicated only in five. As to the remaining patients with this affection, those who were symptom-free were given no treatment whatever, and those who presented symptoms were provided with a supporting corset, which has had excellent effect in many cases.

From the case histories cited above, it seems justified to draw the conclusion that the operation given by BENTZON constitutes a valuable treatment in cases of sacralization refractory to conservative treatment. This is no large material, it is true, but any large material may not be obtained readily as we consider it indicated only in a small number of the patients suffering from sacralization.

### Summary.

From the comprehensive literature on sacralization it is evident that in many cases this anatomical anomaly gives no symptoms, and that in certain cases it has to be considered the real cause of lumbosacral pains. Many of these cases are amenable to conservative treatment, while in a few cases the affection proves refractory to such treatment and may become completely disabling. In such cases operative treatment is indicated.

As to the method of operation, opinions differ. Many clinicians prefer resection of the sacralized transverse process, while others recommend stabilizing operations. It is emphasized that resection implies a risk of nervous injury, that the operation is difficult technically, and that experience shows that sacralization may take place again.

Mention is made of a stabilizing operation given by BENTZON, the principle of which is application of the tibial bridge transversally, extending from one posterior superior iliac spine and passing between the spinous processes of the 4' and 5' lumbar vertebrae to the opposite posterior superior iliac spine.

This operation has been performed on five patients, four women and one man. In three of these cases the operative result has been fully satisfactory, all three patients being now perfectly symptom-free and able to work — respectively 1, 2 and 3 years after the operation. One patient who previously, in another hospital, had been submitted to an Albee operation and to attempt at resection of the sacralized transverse process that was

given up, has now improved considerably but is not symptom-free. Finally, in one patient the result is not good — because of fractures of the bridge. After this complication has been treated by immobilization, however, the condition of the patient, who is still under observation, appears to be improved.

### Zusammenfassung.

Aus der sehr reichhaltigen Literatur über Sacralisation geht hervor, dass diese anatomische Anomalie in vielen Fällen nicht symptomezeugend ist, dass sie aber in gewissen Fällen als die eigentliche Ursache lumbosacraler Schmerzen betrachtet werden muss. Vieler dieser Fälle sind einer konservativen Behandlung zugänglich, während einzelne einer solchen Behandlung trotzen und invalidierend werden können. In diesen Fällen ist Operation indiziert.

Hinsichtlich der Operationsmethode besteht Uneinigkeit. Viele ziehen es vor, den sacralisierten processus transversus zu resektieren, während andere stabilisierende Operationen empfehlen.

Es wird hervorgehoben, dass die Resektionsoperation ein Risiko für Nervenlasionen in sich schliesst und dass es eine technisch schwierige Operation ist, auch hat man die Erfahrung gemacht, dass die Sacralisation sich von neuem bilden kann.

Es wird eine von BENTZON angegebene stabilisierende Operation besprochen, deren Prinzip in der Anlegung einer Tibiaspange querüber vom spina ili posterior superior einerseits zwischen processus spinosi vom IV und V Lumbalwirbel hinein bis zum gegenseitigen spina besteht.

Die Operation wurde an fünf Patienten — vier Frauen und einem Manne — vorgenommen. Bei dreien von diesen ist das Ergebnis vollkommen befriedigend, indem sie alle drei seit einem, bezw. zwei und drei Jahren nach der Operation vollständig symptomfrei und arbeitsstüchtig sind. Ein Patient, der früher an anderer Stelle einer Albee's Operation und einem aufgegebenen Versuch einer Resektion des sacralisierten processus transversus unterworfen gewesen war, ist bedeutend gebessert, aber nicht symptomfrei. Bei dem letzten Patienten ist das Resultat nicht gut, da eine Fraktur der Spange eingetreten ist. Nachdem diese Komplikation mit Immobilisation behandelt wurde, scheint eine Besserung vorzuliegen. Der Patient ist noch unter Observation.

## Résumé.

Il ressort de l'abondante littérature publiée sur la sacralisation que, dans beaucoup de cas, cette anomalie anatomique ne provoque pas de symptômes, mais qu'elle doit être considérée dans certains cas comme la cause proprement dite de douleurs lombosacrées. Beaucoup de ces cas peuvent être soumis au traitement conservateur, celui-ci reste toutefois sans effet sur certains d'entre eux qui peuvent alors devenir invalidisants. L'opération est indiquée dans ces cas.

Certaines divergences d'opinion se font valoir par rapport à la méthode opératoire. Beaucoup préfèrent pratiquer la résection des apophyses transverses de la vertèbre sacralisée, tandis que d'autres recommandent les opérations stabilisantes.

Il est relevé que la résection comporte le risque de lésion des nerfs, que c'est une opération difficile au point de vue technique et que l'on a constaté que la sacralisation pouvait se reformer.

Il est rendu compte d'une opération stabilisante indiquée par BENTZON dont le principe est constitué par un pont de tibia, fixé d'un côté à l'apophyse postérieure supérieure, passant entre les IV et V vertèbres lombaires pour aboutir à l'apophyse opposée.

Cette opération a été pratiquée sur cinq malades, quatre femmes et un homme. On a obtenu un résultat entièrement satisfaisant dans trois de ces cas, les trois malades en question ne présentant aucun symptôme et étant aptes au travail respectivement un, deux et trois ans après l'opération. Chez un malade soumis ailleurs à l'opération Albee et à un essai de résection de l'apophyse transverse sacralisée qui fut ensuite abandonné, on a constaté une amélioration considérable, mais non la disparition des symptômes. Chez le dernier malade le résultat n'a pas été bon, étant donné qu'il s'est produit une fracture du pont. Depuis que cette complication a été traitée par l'immobilisation, il semble y avoir amélioration. Le malade est toujours en observation.

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## Dissection of the Cervical Lymph Node Regions for Metastasis from Malignant Tumors of the Lip, Oral Cavity and Pharynx.

By

IVAR R SANDBERG

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The treatment of malignant tumors of the lips, oral cavity and pharynx is nowadays mainly radiologic, and even the cases requiring electrocoagulation are generally handled by the radiologists. Only occasional patients are referred to surgery, for example, cases requiring wedge excision of a lip cancer that has already been irradiated. Meantime, the treatment of metastases in the lymph nodes is still predominantly surgical, and at the Surgical Clinic of Karolinska Sjukhuset we have treated a relatively large number of cases of metastasis to the lymph nodes of the neck from tumors with the sites mentioned, referred to us by the Radiumhemmet.

Since the radical nature of these lymph node operations requires a special technique, I thought it might be interesting to report on the experiences in this field gathered at the Surgical Clinic. To begin with, I shall give a brief account of the route followed by the metastases from the primary tumors to the first lymph node stations.

From the *lower lip* the lymphatics lead primarily to the submental and the submandibular lymph nodes, from the *upper lip* they lead to the submandibular nodes and, sometimes, to the preauricular and to the inferior parotid node also. The medial lymphatics in the lower lip anastomose with each other. Consequently, metastases from lip cancer are first observed in the lymph nodes mentioned (fig 1).

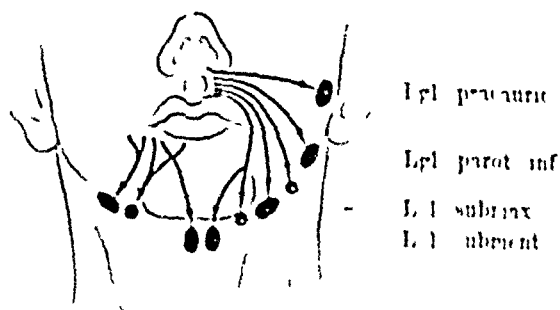


Fig. 1 Stations for lymph node metastases in cancer of the upper and the lower lip (All figures are reproduced from Schürer and Linn: *Deutsche Zeitschrift für Chirurgie* 1939)

Likewise in oral cancer the submandibular lymph nodes are the first station for metastases, which less frequently are seen in the parotid node and only occasionally in the preauricular node. Therefore in cases of metastasis from lip or oral cancer it is mainly the submental and submandibular regions that require dissection (fig. 2)

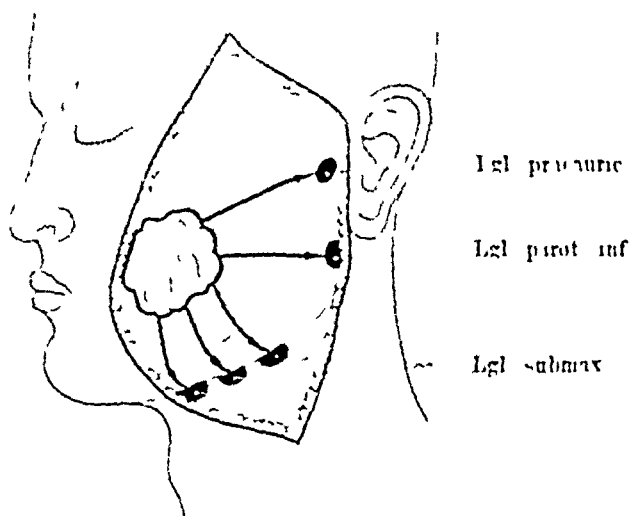


Fig. 2 Stations for lymph node metastases in oral cancer

*Cancer of the tongue* is another matter. A number of lymphatics pass from the tongue, particularly its anterior portion, to the submental and submandibular lymph nodes. From the central and posterior portions of the tongue, however, the lymphatics run directly to the superior and inferior deep cervical lymph

nodes, and to those under the omohyoid and digastric muscles. Therefore, tongue cancer may extend directly to all these lymph node regions. Another important point is that the lymphatics from the tongue are partly crossed, so that a tumor on the left side of the tongue may extend to the right side of the neck and vice versa (figs 3 and 4).

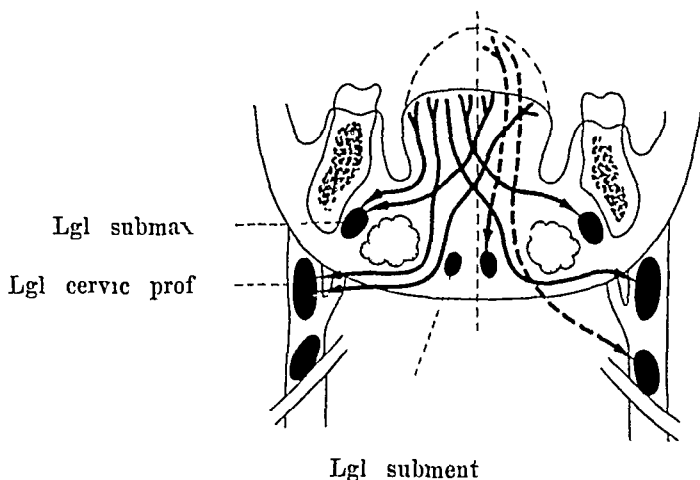


Fig 3 Lymphatics from the tongue are partly crossed

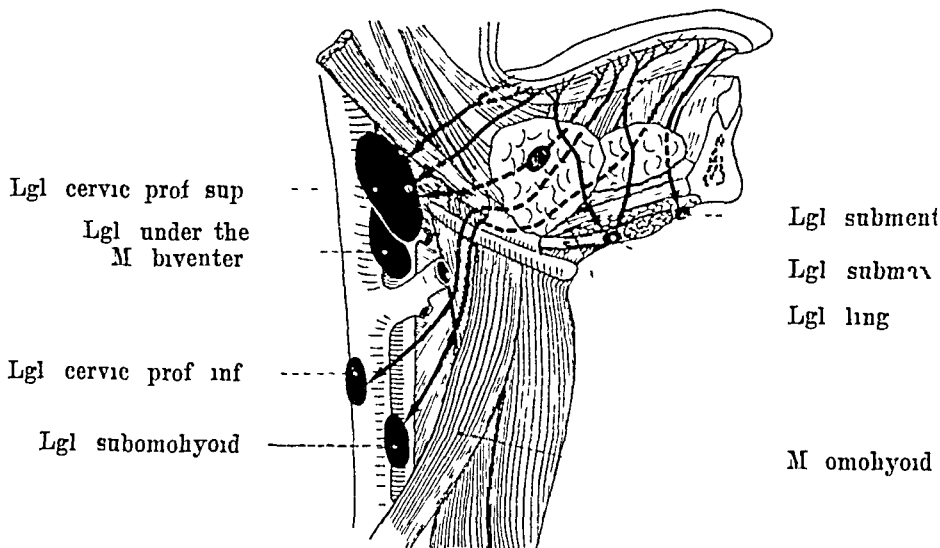


Fig 4 The first stations for metastases in cancer of the tongue

Lymph vessels pass directly from the gingiva, the floor of the mouth and the palate to the nodes beneath the mandible as well as to the deep nodes of the neck.

The first station for lymph node metastases from tonsillar and pharyngeal tumors is provided by the superior and inferior deep cervical lymph nodes. In the latter form of tumor, the retropharyngeal nodes may also be involved (fig 5)

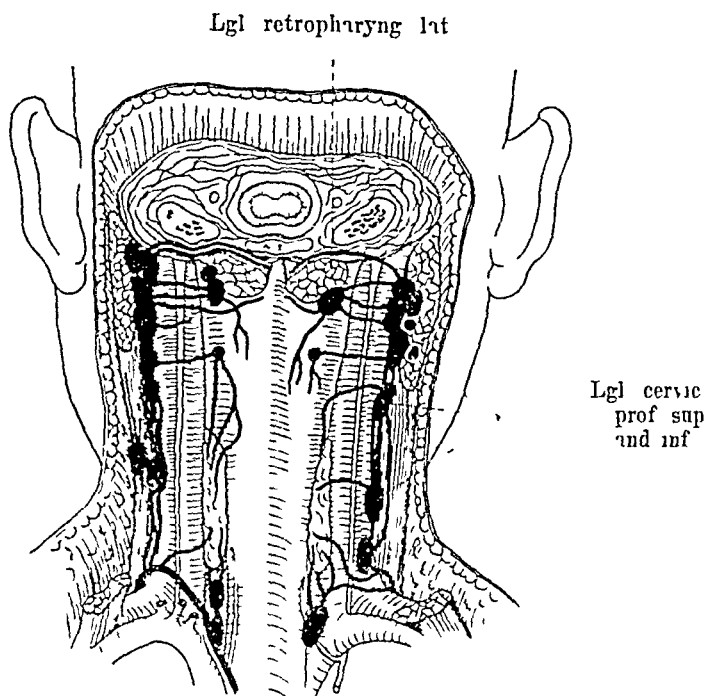


Fig 5 Stations for lymph node metastases in cancer of the pharynx (seen from behind)

The surgical interventions for metastases from the tumors in question can be divided into three groups 1) Radical dissection of all the above-mentioned lymph node stations, with the possible exception of the submental and submandibular regions (particularly in tumors in the pharynx and tonsils) 2) Dissection of the submandibular region and possibly the submental region also 3) Removal of single lymph nodes or groups of lymph nodes. The last-mentioned operation should, however, be abandoned as a method of treatment, it only being justified for diagnostic purposes.

*Anesthesia* Endotracheal anesthesia with nitrous oxide-oxygen-ether, sometimes combined with intravenous narkotal, was the standard method, particularly in major operations. Some of the minor operations were done under local anesthesia, but since the

loss of sensibility in the submandibular region with this method often proved inadequate when the salivary gland was drawn out and the vessels in its neighbourhood were ligated, it was found advisable to give narkotal in these cases

*Operative technique* Several different incisions were used, the most common one being an angular flap incision with one of the arms of the angle passing along the margin of the lower jaw and the other running down to the medial part of the clavicle. In some cases the angle was directed toward the angle of the mandible, in others toward the mastoid process. However, a tendency to edema was not seldom observed in the angular flap of skin for a few days after the operation, and therefore the stellate incision described by MORESTIN is probably preferable. This incision is made from the mastoid process to the level of the greater cornua of the hyoid bone and on to the angle of the mandible. Another incision is then run from the hyoid bone down to the medial part of the clavicle and if necessary can be deflected laterally in the supraclavicular fossa. The incision is made through the skin and platysma after which the flaps of skin are prepared and drawn to the side so that the whole area to be dissected lies exposed. The external jugular vein is ligated and cut. Next follows dissection along the margin of the lower jaw with ligation of the submental, anterior facial and anterior parotid veins and the submandibular artery. The salivary gland is removed as completely as possible since behind its fascia lie small lymph nodes, which may be the site of metastases. The external maxillary artery is ligated and cut, and the posterior belly of the digastric is dissected free and divided in order to provide access to the nodes behind it. The submental lymph nodes are removed, together with the fat around them, and dissection is continued diagonally down to the anterior insertion of the sternocleidomastoid muscle. The omohyoid muscle and the nodes behind it are included in the tissue dissected. The sternocleidomastoid muscle is divided inferiorly and lifted up, thereby making the internal jugular vein accessible. In order to effect radical removal of the deep cervical nodes, it is often necessary to resect this vein. It is submitted to double ligation and then cut, care being taken to spare the vagus. Thereafter dissection is continued bluntly and the internal jugular, with any lymph nodes on its posterior aspect, is elevated along with the muscle (fig. 6). The operation is carried out in stages, with ligation and cutting of the superior

thyroid, common facial, lingual, and pharyngeal veins. The last-mentioned small veins retract if ruptured, in which case they are difficult to grasp without injuring the hypoglossal nerve. The vagus and the arch of the hypoglossus are left intact, but the descending branch of the hypoglossus, like the accessory nerve often has to be resected when removing the sternocleidomastoid

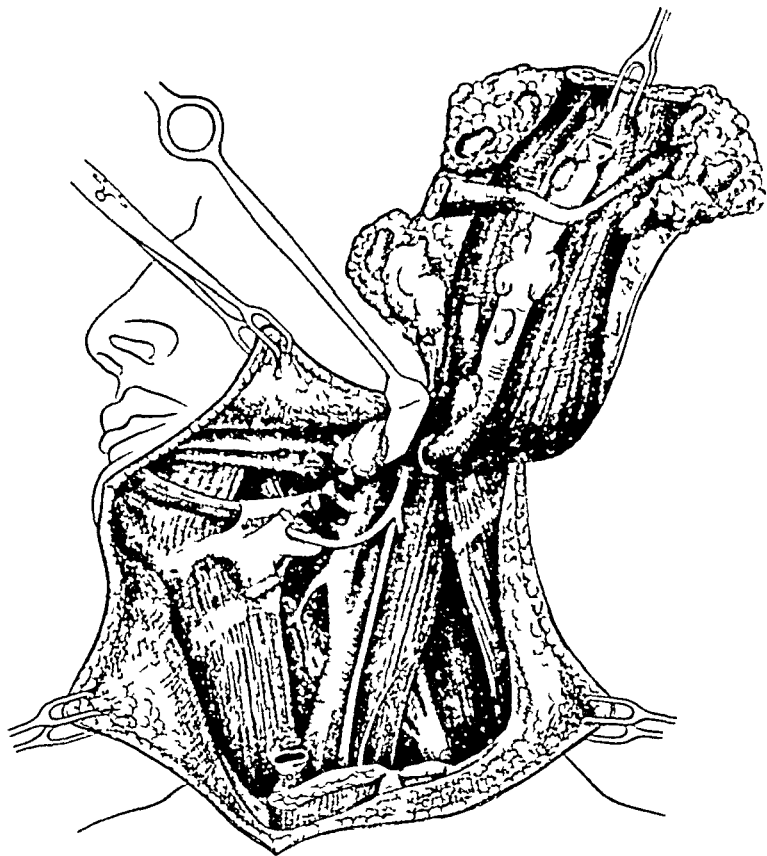


Fig 6 The submental and submandibular regions are dissected and the salivary gland is removed. The internal jugular vein and the sternocleidomastoid muscle are divided inferiorly and lifted up.

muscle. The internal jugular vein is ligated superiorly and cut, after which the whole dissected mass of tissue is removed by dividing the sternocleidomastoid muscle at the mastoid process. The bleeding from the branches of the posterior auricular and occipital arteries is checked. Drainage is established through a rubber tube. The platysma and skin are sutured.

Our series consisted of 73 patients, 56 men and 17 women, on whom altogether 93 operations were performed. The youngest

patient was 35 years, the oldest 80 years. The age distribution is shown in table 1.

Table 1

Age	31—40	41—50	51—60	61—70	71—80
No. of patients	5	13	25	17	13

Seventy-five per cent of the patients were over 50 years, 41 per cent over 60 and 18 per cent over 70.

The site of the primary tumors and the nature of the operations appear from Table 2.

Table 2.

I = Massive radical dissection

II = Dissection of submandibular and sometimes of submental region

III = Extirpation of single lymph nodes or groups of lymph nodes

Diagnosis	No. of patients	M	F	Operation	
Labial cancer	32	30	2	I II III	6 37 2
Lingual cancer	12	7	5	I II III	10 4 3
Sublingual cancer	4	2	2	I II III	3 1 1
Buccal cancer	6	4	2	I II III	3 2 1
Gingival cancer	8	4	4	I II III	7 1 1
Cancer of hard palate	2	1	1	I II	1 1
Tonsillar cancer	2	2	—	I	2
Tonsillar sarcoma	1	—	1	III	1
Cancer of epiglottis	1	1	—	I	1
Hypopharyngeal cancer	2	2	—	I III	2 2
Nasopharyngeal cancer	3	3	—	I	4
Total	73	56	17	I II III	39 46 8

Thirty-two of the cases were cancer of the lip. Most of these patients were submitted to removal of the submandibular and submental lymph nodes (37 operations), while only six underwent radical dissection. However, as might be expected, the latter operations were considerably more frequent in the other groups and in certain of them constituted the only operative procedure. As appears from the tables, these radical interventions were done 39 times, extirpation of the submandibular region with or without the submental region was done 46 times and removal of single nodes or groups of nodes was done 8 times.

*Complications.* With radical dissection, particularly when the case verges on inoperability, it is almost impossible to avoid injuring nerves. — Transitory paresis of the inferior facial branch often occurs, but permanent damage is also sometimes done. — When resecting the sternocleidomastoid muscle, the accessory nerve is quite frequently severed or injured, and this results in partial paralysis of the trapezius muscle, which, however, receives its innervation to a varying extent from the cervical plexus (CII, CIII and CIV). Damage to the accessory nerve is not, as a rule, followed by any real limitation of motion in the head or arm. — As mentioned above, the descending branch of the hypoglossal nerve not infrequently has to be sacrificed, and this sometimes applies to the arch too. The latter complication may give rise to considerable difficulties with mastication and deglutition. — The records reveal that mild injuries to the facial nerve occurred in six of the cases in the present series. In one case the vagus was cut without any apparent ill-effects, and in three cases the trunk of the hypoglossus was severed. Damage to the accessory nerve occurred in the majority of the radical dissections.

Resection of the sternocleidomastoid muscle does not appear to entail any limitation of movement, and not even in the two cases in which the operation was bilateral did the patients complain of any disability in this respect. — Dissecting out the internal jugular vein is sometimes a slow and difficult process since the tissues are very tough as a result of irradiation. Ruptures of the wall of the vessel may give rise to fatal air embolism, and hemorrhages from the superior parts of the vein may be especially hard to check. The internal jugular can be resected bilaterally, and some workers even claim that this can be done in one session. Others, however, recommend sparing the vein on one side. Our series included 18 cases of resection of the internal jugular. In

two of them the operation was bilateral, but in both it was done in two stages. One of these patients did not show appreciable stasis, but the other exhibited considerable stasis in the head, which may, however, have been at least partly caused by other complications (cf. fatal case).

In one of the cases a small lesion was made on the common carotid artery, but it could be repaired with sutures. The same patient contracted a hemiplegia in connection with the operation, and this was considered to be due to a cerebral thrombosis. — Resection of the common carotid artery has never been undertaken at our Clinic. The procedure was considered in one case in which the growth had extended to the wall of the artery. The surgeon compressed the vessel with his finger as an experiment, but the corresponding half of the face immediately grew appreciably paler, the pallor spreading to the other side of the midline. The risk of cerebral circulatory disturbances was therefore considered too great, and the idea of arterial resection was given up. — However, ligation of the external carotid artery was done at the request of the Radiumhemmet physicians in three cases of dissection of lymph node regions in order to lessen the danger of hemorrhage from the main growth.

Local edematous swelling often develops after the operation. It is usually moderate and may be restricted to the skin flap in the angular incision. On the other hand, the swelling may be considerable, and, particularly in bilateral operations, it may even endanger the patient's life due to laryngeal edema. The only patient to die in our series expired from anoxemia resulting from laryngeal edema.

Hematoma complicated the postoperative course in three cases, and in one of them the patient also contracted pulmonary embolism, which however, cleared up satisfactorily. — An infection developed in the wound in four cases, but in none of them was it serious.

*Mortality.* One of the 73 patients (K 873/44) died in connection with the operation, as follows.

A 54-year old man was sent to the Surgical Clinic on March 28, 1944, by the Radiumhemmet, with the diagnosis clinically bilateral metastases in the lymph nodes of the neck from a nasopharyngeal cancer. I operated upon the patient on March 31, using endotracheal anesthesia with nitrous oxide-oxygen-ether and narkotal. Massive radical dissection on the right side with resection of the sternocleidomastoid muscle and the internal jugular vein was done. A metastasis

was found growing like a plug in the internal jugular. For the first few days after the operation the patient had considerable deglutition difficulties, which, however, gradually cleared up. The patient was allowed to get up five days postoperatively, and he was afebrile after a week. The wound healed without complications. On April 26 I performed the second operation using the same anesthesia as before. Radical dissection of the lymph nodes on the left side of the neck with resection of the sternocleidomastoid muscle and the internal jugular vein was done. A series of nodes, attached to the inner aspect of the vein, were removed at the same time. No damage was done to the hypoglossus or vagus or to the branch of the accessory nerve to the trapezius. — Unfortunately the tracheal tube was removed while the patient was still in the third phase of narcosis. Soon after his return to the ward he turned cyanotic and it was obvious that the air passageway was not free. The mandible was drawn forward and a tube was inserted in the nose, but to no avail. The patient was then returned to the operating room. On arrival there he was deeply cyanotic, exhibited orbital edema and was practically moribund. Intubation was done immediately and oxygen was administered, and the danger seemed to be averted. By the time the patient again left the operating room he was in good condition and his color was almost normal. The next day, April 27, the general condition was only slightly impaired, and the patient was able to drink without difficulty. His color was good. Ever since the operation the whole head had been somewhat swollen and the eyeballs had protruded, but these signs had now begun to regress. On April 29 the patient felt well. He had been allowed to be up a little since the day before. He had no respiratory trouble. He was able to write letters. However, soon after the midday meal he began to have increasing difficulty in breathing with moderate stridor. These symptoms grew steadily in intensity except for a respite which lasted only a few minutes. The patient became increasingly restless and anxious and exhibited pronounced cyanosis. He was immediately given oxygen, ephedrine and intravenous calcium in order to check the laryngeal edema presumably present. At the same time he was taken to the operating room for intubation. In the elevator he suddenly grew worse. He became pale, his pulse was imperceptible and there was froth at his mouth (pulmonary edema). Intubation, artificial respiration and oxygen, intravenous stimulants, cardiac massage were without effect, and the patient died.

This was clearly a case of anoxemia caused by respiratory obstruction (intubation showed edema in the larynx) with progressive cardiac insufficiency and finally pulmonary edema.

Microscopic examination of the specimen from the right side showed a metastasis in the lymph nodes and firm connective tissue emanating from a cancer of low differentiation. — No cancer metastases were found in the lymph nodes in the specimen from the left side (O. REUTHER-WALL). — Autopsy revealed that the metastases in the neck had been removed radically, but that the sphenoid sinus was the site of large medullary tumour proliferations, which microscopically showed the picture

of infiltrative cancer with a very slight tendency to cornification so that in some places the tissue was reminiscent of basal cell cancer. There were abundant mitoses in the compact cell columns. The internal organs exhibited pronounced general stasis. There was edema in the trachea and the larynx (Å. WILTON).

The mortality for the whole material was thus only 1.4 per cent. If only the massive radical dissections performed on 37 patients were included, this figure would amount to 2.7 per cent.

The mortality at the Zurich Clinic was 14.4 per cent for the years 1927 to 1936 (13 deaths among 113 patients), but there they apparently mainly used the massive radical method.

*The period of treatment* from the operation to discharge varied from 5 to 41 days, with an average of 10.5 days. Most of the patients were transferred directly from the Surgical Clinic to the Radiumhemmet for postoperative irradiation, a circumstance that may have contributed to the shortness of the stay in the former.

*Histologic examination* The preoperative clinical diagnosis was tumor metastasis or strong suspicion thereof in all 93 cases. In ten cases, however, histologic examination disclosed tuberculous adenitis or probable tuberculosis. In 15 cases, only nonspecific inflammatory changes could be observed. In 67 cases histologic examination revealed cancer in one or more lymph nodes. Squamous-cell cancer with or without cornification was present in the majority of these cases, while reticular cell sarcoma was present in one case in which there was a tonsillar tumour of the same kind. Thus more than one-quarter of the series proved not to have metastases, tuberculosis being present in 10.8 per cent and nonspecific changes in 16 per cent.

*Radiologic effect on lymph node metastases* PRYM in 1924 stated that it could not be decided histologically whether a pathologically changed piece of tissue had been irradiated or not, since the changes caused by roentgen therapy could also appear spontaneously. In both cases vacuolar degeneration of the nuclei and cytoplasm of the cancer cells and the formation of foreign body giant cells could be seen. The destruction of lymphocytes observed immediately after irradiation could also be found near non-irradiated necrotic cancer, according to PRYM. These claims were confirmed in part by MCGREGOR in 1934. PRYM further stated that the roentgen rays had a primary effect on the tumor parenchyma and also caused secondary changes in the vascular apparatus.

QUICK and CUTLER, on the other hand, were of the opinion that the massive central necrosis to be seen following irradiation of carcinomatous lymph nodes undoubtedly was of vascular origin and should be regarded as anemic necrosis. They considered that the extent of the necrosis was in direct proportion to the amount of irradiation. Meantime, MCGREGOR would go no further than to say that the vascular changes were a contributory cause of the destruction of the cancer cells and that no parallelism existed between the vascular changes, the carcinoma necrosis and the roentgen doses.

QUICK and CUTLER further reported that a favorable radiologic effect, marked by the regression of the tumor, was accompanied by a reaction in the neighbouring tissue in the form of proliferation of young fibroblasts, exudation of lymphocytes and leucocytes and of plasma cells and new capillaries, and of formation of granulation tissue. With regard to the giant cells, ENGELMANN was convinced that these derived from cancer cells and were tumor giant cells which could give rise to recurrences. This opinion, however, was not borne out by MCGREGOR's investigation published in 1934 — She was unable to find any histologic difference in the effect of roentgen and radium treatment — The lymphatic tissue showed no signs of damage caused by irradiation.

As mentioned above, 68 of the 93 operative specimens were diagnosed histologically as cancer. A preoperative irradiation of the lymph node regions are done in all these cases. The examinations were made at the Department of Radiopathology of the King Gustaf V Jubilee Clinic by Professor O REUTERWALL and his assistant, Dr L SANTESSON, who, at our request, appended to the histologic diagnosis in each case a note stating whether or not they were able to observe in the specimens regressive changes which could be considered due to the effect of irradiation. As appears from what has already been said regarding irradiated tissues, histologic evaluation of the effect of irradiation is difficult and, since the changes are so slight, is almost sure to be highly uncertain. This point was stressed by REUTERWALL and SANTESSON. Nevertheless, in 42 of the 68 cancer cases (62 per cent) they considered they had found more or less pronounced changes of the type believed to be caused by irradiation. The remaining 26 cases (38 per cent), on the other hand, presented no distinct changes and were therefore judged by the pathologists to have suffered no demonstrable effect of irradiation.

*Follow-up* The cases under discussion were not suited for after-examination, since too short a time had elapsed between the operation and the present investigation. However, the results one year after operation are assembled in table 3

Table 3

Diagnosis	Number of patients			
	Free from evidence of disease	Recurrence	Death from cancer	Death from other causes
Labial cancer	18	5	1	—
Lingual cancer	5	—	6	—
Sublingual cancer	2	1	—	—
Buccal cancer	2	—	1	1
Gingival cancer	2	1	2	1
Cancer of hard palate	1	1	—	—
Tonsillar cancer	—	—	1	—
Cancer of epiglottis	1	—	—	—
Nasopharyngeal cancer	—	—	1	—
Total 53	31	8	12	2

Cancer of the lip showed the best results with 18 patients free from evidence of the disease, 1 death and 5 recurrences. One of the recurrences appeared at the site of the primary tumor and four involved the neck, two of them the operated side, and two took the form of inoperable metastases on the nonoperated side. One of the patients with cancer of the tongue who died expired from bronchopneumonia and a heart condition nine and a half months after the operation. However, since this patient had a local recurrence, it was considered that he should be listed as dead from cancer. — The one recurrence among the sublingual cancers consisted of a small local growth which could be coagulated. — Among the next group, one patient died of oral cancer and one of pulmonary cancer, but the latter exhibited a lymph node on the neck in which metastasis was suspected. The patient with gingival cancer who suffered a recurrence had not undergone radical operation. Another patient with the same diagnosis died of coronary thrombosis ten months after the operation. The case of recurrence in the hard palate was said to be suspected but not proved.

Thus 31 of the patients (58 per cent) examined one year after the operation were free from evidence of the disease. However, if the relatively benign lip cancers are eliminated, it will be found

that only 13 patients were free from evidence of the disease, while 3 showed recurrences, 11 died of cancer and 2 of some other disease

### Summary.

The route followed by metastases from malignant tumors in the lips, oral cavity and pharynx to the first lymph node stations is described. The operative procedures are divided into three groups: 1) Radical massive dissection of all the first lymph node stations; 2) Dissection of the submandibular region with or without the submental region; 3) Extirpation of single lymph nodes or groups of lymph nodes. The last-mentioned method should only be used for diagnostic purposes.

The operative technique is described in detail.

The series consists of 73 patients, 56 men and 17 women, on whom altogether 93 operations were performed. Seventy-five per cent of the patients were over 50, 41 per cent over 60, and 18 per cent over 70 years of age.

The complications are described.

The mortality for the whole series was 1.4 per cent (one death among 73 patients), for the massive radical dissections (39 operations on 37 patients), 2.7 per cent. The average stay in the Surgical Clinic was 10.5 days. Histologic examination showed cancer in the cervical lymph nodes in about 75 per cent of the cases, and nonspecific changes or tuberculosis in the remainder.

The effect of irradiation on lymph nodes is discussed.

Although the operation was too recent in most of the cases to permit of an adequate period of observation, the results one year after the operation were nevertheless assembled in a table, from which it is seen that 31 of the 53 patients were free from evidence of the disease, 8 had recurrences, 14 had died of cancer and two had died of some other disease.

### Zusammenfassung.

Bericht über den Verbreitungsweg der Metastasen bei malignen Tumoren der Lippen, der Mundhöhle und des Rachens in den ersten Lymphdrüsenstationen. — Die operativen Eingriffe werden in 3 Gruppen eingeteilt: 1. Radikalausraumung sämtlicher ersten Lymphdrüsenstationen in einem Stück; 2. Ausraumung der

Submandibularregion, evtl auch der Submentalregion 3 Entfernen vereinzelter Drusen oder Drusenpakete Die letztgenannte Methode ist nicht zu therapeutischen, sondern nur zu diagnostischen Zwecken zu verwenden — Eingehende Beschreibung der operativen Technik — Das Material besteht aus 73 Kranken, 56 Männern und 17 Frauen, an denen im ganzen 93 Operationen vorgenommen wurden 75 % der Kranken waren über 50 Jahre alt, 41 % über 60 Jahre und 18 % über 70 Jahre — Bericht über die Komplikationen — Die Sterblichkeit am Gesamtmaterial 1 4 % (1 Kranker von 73 gestorben), bei den grossen Radikalausraumungen (39 Operationen an 37 Patienten) 2,7 % — Krankenhausaufenthalt durchschnittlich 10 5 Tage Die pathologisch-anatomische Diagnose ergab, dass in etwa 75 % ein Krebs der Halslymphdrusen vorlag, in den übrigen Fällen unspezifische Veränderungen oder Tuberkulose — Die Wirkung der Strahlenbehandlung der Drusen wird erörtert — Wegen der kurzen Zeit, die bei der Mehrzahl der Fälle nach der Operation verflossen ist, wurde nur eine Zusammenstellung der ein Jahr nach der Operation vorliegenden Ergebnisse gemacht Von 53 Kranken waren 31 gesund, 8 hatten Rezidive, 14 waren an ihrem Krebs und 2 an anderen Krankheiten gestorben

### Résumé.

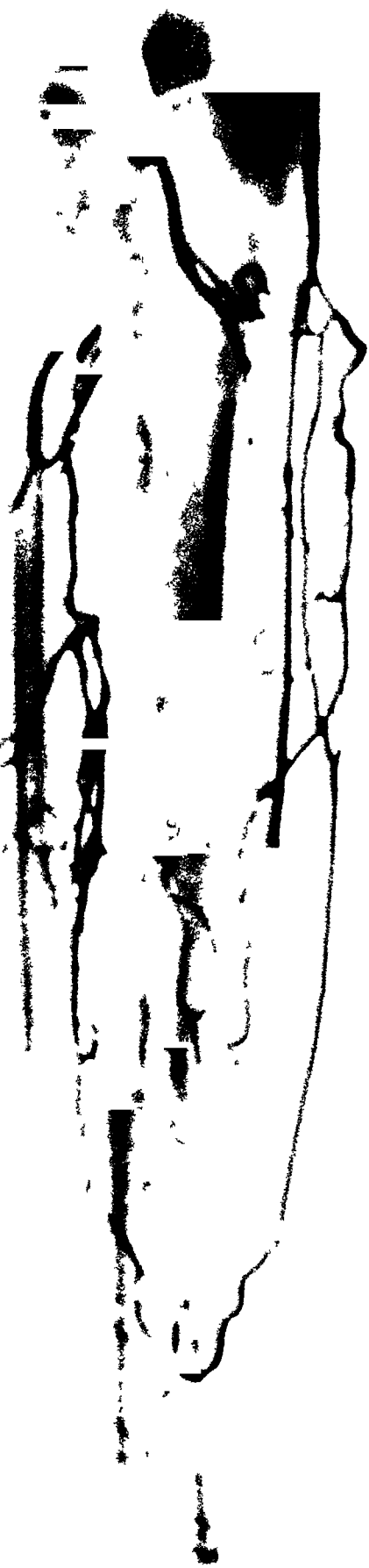
Résumé concernant la voie de diffusion des métastases de tumeurs malignes des lèvres, de la cavité buccale et de l'œsophage vers les ganglions lymphatiques de première ligne Les interventions opératoires sont divisées en trois groupes 1) Nettoyage radical d'un coup de tous les ganglions lymphatiques de première ligne 2) Nettoyage de la région sous-maxillaire plus, éventuellement, de la région sous-mentonnière 3) Extirpation de ganglions isolés ou de paquets de ganglions Cette dernière méthode réservée uniquement au diagnostic Description détaillée de la technique opératoire

Le matériel comprend 73 cas, 56 hommes et 17 femmes, chez lesquels on pratiqua 93 opérations 75 % des malades étaient âgés de plus de 50 ans, 41 % de plus de 60 et 18 de plus de 70 ans Résumé des complications Mortalité calculée sur tout le matériel 1 4 % (1 malade décédé sur 73), sur les grands nettoyages radicaux (39 opérations dans 37 cas) 2 7 % Durée de traitement 10 1/2 jours en moyenne

Diagnostic anatomo-pathologique dans 75 % des cas, cancer des ganglions lymphatiques du cou et dans le reste des cas, modifications sans spécificité ou tuberculose ganglionnaire. L'auteur discute l'action du traitement aux rayons. Étant donné la brièveté du temps écoulé depuis l'opération dans la plupart des cas, l'auteur s'est borné à faire une synthèse des résultats un an après l'opération. Sur 53 malades, 11 se portaient bien, 8 accusaient une récurrence, 14 avaient succombé à leur cancer et 2 étaient morts d'affections intercurrentes.

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*Treatment of  
Hemorrhoids  
Hemorrhoids*

**HEPARIN**

*Vitrum*



From Dr Stein F Holst's Private Urologic Department  
Vor Frue Hospital and  
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## Postoperative Bacterial Findings in the Lower Urinary Tract after Suprapubic Prostatectomy.

By

ERLING F HJORT and KRISTIAN SLETVOLD

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The two main dangers connected with suprapubic prostatectomy are *infection* and *hemorrhage*. An effective fight against the danger of infection supposes an intimate knowledge of the types of bacteria most common in the urine.

The object of the present work has been investigation of the bacterial flora in the lower parts of the urinary tract by daily examinations during the period following immediately after prostatectomy, the end being determination of the types of bacteria that usually have to be taken into account. Second, to look for a possible connection between variations in the bacterial flora and eventual complications in the postoperative course. The latter question dropped by itself as the examinations showed that the types of bacteria in each case remained constant without mentionable signs of variation.

Our work had also another end, namely to investigate whether the prostate gland might contain types of bacteria that were not at the same time present in the urinary tract. As it is known, the histologic examination of the prostate presenting the clinical picture of "prostatism" meets partly with the picture of pure hypertrophy, partly with that of prostatitis and partly with a combination of these forms. Therefore we wanted to ascertain whether bacteria might be present in the very prostate and whether these preferably were to be found in a histologic picture of prostatitis. Next we also aimed at finding out whether the

been working, 1 e 1) the operating — dressing — and irrigational technique used by Dr STEIN F HOLST at Vor Frue Hospital and 2) the technique used by us in collecting our bacteriologic material, and finally 3) the selection of cases made by us

### Operational Technique.

Dr STEIN F HOLST performs his suprapubic prostatectomies after preliminary cystoscopic and urethioscopic examination. The examination that is made under surface anesthesia of the urethra has in the present cases as a rule been carried out weeks or months before the operation. One-stage suprapubic prostatectomy is made under spinal anesthesia with parocain 0.15. The patient is catheterized on the operating table, and the catheter is left in place until the bladder has been opened. Through the catheter the bladder is irrigated and then filled with about 300 cc of air. The operation is performed through the opening offered by a large incision of the bladder and with a self-supporting bladder speculum. After a slit has been made around the internal urethral opening by means of an electric knife the prostate body is enucleated in the usual manner with two fingers in rectum and one finger in the bladder. Before the operation the surgeon has put an extra sleeve on left forearm. This sleeve is removed after the enucleation and the glove is changed. The possible rests of the prostate are removed through the bladder incision and under guidance of the eye, bed of the wound is smoothed and partially closed with three posterior and one or two anterior catgut sutures, according to Harris' method. If the bleeding has ceased, the bladder and the abdominal incision are closed around a Pezzer catheter. If the bleeding continues, the bed of the prostate is packed under guidance of the eye with silver nitrate tampon that is carried through the abdominal opening beside the Pezzer catheter. The catheter in urethra is removed before the slit around the internal urethral opening is made and a fresh catheter inserted into the bladder after the Harris' sutures have been accomplished. The whole of the operation takes about 1 hour. The skin is covered with towels and compresses that are fastened underneath the bladder speculum to edge of the wound. Eventual packing as a rule is removed 6th day after the operation.

## 1 Technique of Dressing and of Irrigation

After the operation the bladder is irrigated through the Dauer- and Pezzer catheter, and the afternoon of the operation day a permanent irrigation is established in form of instillation through the Dauer catheter and outlet through the Pezzer catheter. From the Pezzer catheter urine and the irrigation fluid are led into a closed jar with double perforation of the cork. This jar is connected with an apparatus that produces suction in the urine jar. Silver nitrate solution 1/10,000 is used for the irrigation. From now on rubber tubes and glass connecting tips are changed and boiled every day. The urine jar is changed daily and rinsed with water and "Kionsteinsol". This irrigation is kept up for 10 days.

The dressing around the Pezzer catheter consists of dry sterile gauze and the dressing around the external urethral opening consists of a sterile strip of gauze fastened between the adhesive plaster and glans penis and also of a compress placed around penis. All this dressing is changed twice a day, and the skin wiped with iodized benzin and alcohol, and mouth of urethra with  $H_2O_2$ .

10th day the Dauer catheter is removed (in exceptional cases it has been pulled out by the patient himself before this time and is then not replaced), and the irrigation is discontinued. The urine now passes through the Pezzer catheter into the urine jar that still is connected with the suction apparatus. The Pezzer catheter as a rule is removed on 17th day, whereafter an Irings bandage is applied. From 10th to 17th day the bladder is irrigated in the morning with sterile water followed by installation of 50 cc of silver nitrate  $\frac{1}{2}$  % solution. In the evening it is irrigated with oxycyanat hydragryrate 1/3,000 solution. The dressing and the rubber tubes are changed as explained before.

Of medications the patient has received partly streptan (2 tabl  $\times$  3) partly camystit (100 gms in the course of  $2\frac{1}{2}$  day with restricted amount of fluid), partly neotropin (1 tabl  $\times$  3) and partly thiotan (sulphamethylthiazol 0.50) 2 tabl  $\times$  3. In the majority of our cases streptan has been given systematically from 3d to 10th day.

During whole of the postoperative period the patient is encouraged to take plenty of fluid, preferably as much as 3 l a day (except when camystit is given).

## 2 a Technique of Collecting Urine Specimens.

The first specimen is taken on the operating table after insertion of the catheter. The urine is received in a sterile Erlenmeyer test tube. The following specimens are collected every day during the following 8 days, after this time every 2 days until removal of the Pezzer catheter. The specimen is obtained through the Pezzer catheter after mouth of the catheter has been cleaned with corrosive sublimate.

All urine specimens have been sent to bacteriologic examination without having been opened.

## 2 b Technique of Bacteriologic Examination of the Prostate Gland.

The enucleated prostate is cut through immediately after the removal by means of a sterile knife, and with a cotton swab a smear is applied to blood-agar medium.

## 2 c Technique of Bacteriologic Examination of Urethra

After the dressing has been removed specimen is taken with a cotton swab from fossa navicularis through the urethral opening. The specimen is smeared onto a blood-agar medium. Culture is made postoperatively daily for 8—14 days.

## 2 d Technique of Bacteriologic Examination of the Skin

Before the operation and before disinfection of the skin this organ is wiped, over the operation field, with a cotton swab dipped in sterile water. After the operation the same performance is repeated after removal of the dressing. The specimen is transferred to blood-agar medium. Culture is made the day of the operation and the following three days in succession.

## 3 Selection of Cases and the Type of Specimens

The majority of our cases is made up by one-stage prostatectomies who has not received preliminary treatment (apart from the cystoscopy), i. e. chiefly "clean" cases. The reason for this selection has been our wish to find out how rapidly a sterile urine becomes infected in connection with prostatectomy, and which types of bacteria may be considered characteristic to the "postoperative bacilluria."

In all were taken the following specimen

1 a	Daily urine specimens in one-stage prostatectomy	33 cases
b	Daily urine specimens in prostatectomy with preliminary retained catheter treatment	1 case
		<hr/> 34 cases
2	Punctate from epididymis	3 punctates
3	Daily blood cultures	10 cases
4	Daily urethral cultures	18 »
5	Daily skin cultures	6 »
6	Cultures from the prostate gland	36 cultures

For the specimens from urine, urethra and skin the importance of the specimens being taken daily has been stressed, because such continuous observation series reduces accidental errors. As a rule daily specimens were taken for 8 days and later every 2 days during the following week.

### Bacterial Findings in the Urine before and after Prostatectomy.

The bacterial findings in the urine appear from what follows. *Before* the operation the urine was sterile in 32 of our one-stage prostatectomies, including the case that had received preliminary retained catheter treatment. In one case the urine before operation contained green streptococci. Later these disappeared. In one case the urine contained *Escherichia paracoli*. This type remained.

*The type of bacteria* in the urine after prostatectomy (up to 18 days' observation time)

*Escherichia coli* appeared predominantly to be the bacteria most frequently found in the urine. It was present in 32 out of the total of 34 cases. Once pointed out it was found in every one of the subsequent daily specimens. In the two cases in which it failed to appear (Nos 54 and 60) its place was taken by *Escherichia paracoli* and *Alcaligenes fecalis*.

*Streptococcus faecalis* came next to it in frequency of bacteria found, namely in 28 out of 34 cases.

The leadership of these two bacteria, *Escherichia coli* and *Streptococcus faecalis* was so absolute compared to all other bacteria, that they may be pointed out as the typical bacteria in the postoperative bacilluria.

Of other bacteria were found

*B. Proteus* in 5 cases

*Staphylococcus aureus* in 3 cases

*Pseudomonas* in 1 case

*Escherichia paracoli* 1 case

*Alcaligenes faecalis* in 1 case

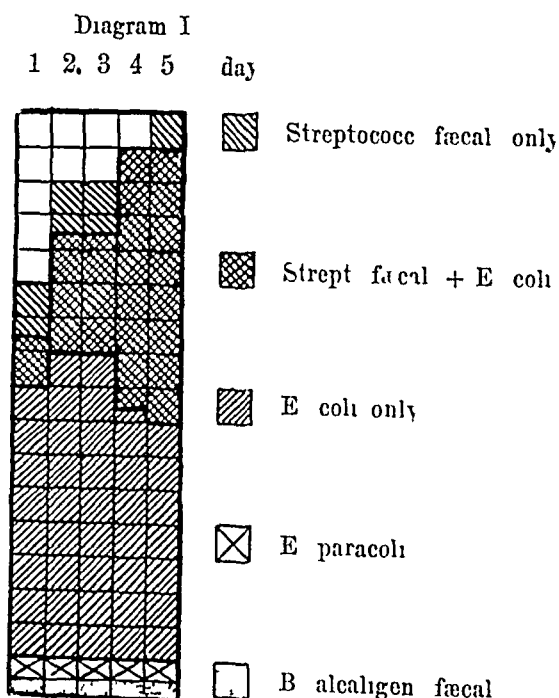
Thus a pure intestinal flora was proved to dominate the picture in urine specimens after prostatectomy. The *Staphylococcus* strikes one as being a rare and more accidental guest, an impression strengthened by the fact that the three findings of *Staphylococci* in the urine were made the first time on the 16th, 20th and 25th day of the same month respectively, at a point of time when suture infections occurred in several of the wounds on the floor, i. e. representing a kind of Hospital infection.

*Point of time* for the infection of the urine

1st day after the operation 24 out of the total 34 urine specimens contained intestinal bacteria

2nd day after the operation the number had risen to 30 out of 34

3d day the number was still 30 out of 34, and in the course of 5 days all the cases had become infected. (See Diagram I.)



Findings of intestinal bacteria in the urine in the first 5 days after prostatectomy

In all cases intestinal bacteria were the first that were pointed out in the urine. Staphylococci occurred the first time on 3d, 4th and 11th day after the operation respectively. *Escherichia coli* was found as the first bacterium in 20 cases, *Streptococcus faecalis* in 6 cases, and simultaneously these two types appeared as first bacteria in 6 cases. Once *Escherichia paracoli* and once *B. alcaligenes faecalis* were discovered as first bacteria (See Tables I and II.)

Table I  
*Bacterial findings in the first 5 days*

	1st	2nd	3rd	4th	5th	6th	day
E coli	19	25	26	30	30		
Strept fecal	6	10	10	16	18		
B alc faec	1	1	1	1	1		
E paracoli	1	1	1	1	1		
Staph aur			1	2	2		

Table II.  
*Bacterial findings in the first 5 days*

1st day	2nd day	3rd day	4th day	5th day
16 times E coli only	18 times E coli only	18 times E coli only	15 times E coli only	14 times E coli only
1 time E paracoli only	1 time E paracoli only	1 time E paracoli only	1 time E paracoli	1 time E paracoli only
1 time B alc faec only	1 time B alc faec only	1 time B alc faec only	1 time Str faec only	2 times Str faec only
3 times Str faec only	3 times Str faec only	3 times Str faec only	15 times E coli + Str faec	15 times E coli + Str faec
3 times Str faec + E coli	7 times Str faec + E coli	7 times Str faec + E coli	1 time B alc faec + Staph aur	1 time B alc faec + Staph aur
				1 time E coli + Str faec + Staph aur
24 times	30 times	30 times	33 times	34 times

The medication that was given during the period after the operation had no influence on the appearance of the bacterial types in the urine, as none of the types showed any tendency to disappear under influence of the medication. Our investigations permit no certain conclusion as to whether the medications administered do produce check in growth of the bacterial cultures. Those cases in which packing had been used showed no difference from the others.

Summing up our findings, we may then claim that the urine after prostatectomy becomes infected with a bacterial flora that with regard to types and mutual quantitative proportion of the types must be characterized as a pure intestinal flora. This infection takes place very rapidly, in the great majority of cases within the first two days after the operation.

The predominant frequency of simultaneous appearance of *Escherichia coli* and *Streptococcus faecalis* seems characteristic to the postoperative condition, in contrast to the 'spontaneous infection' of the urinary tract. For the spontaneous infection of the urinary tract the frequency of *Escherichia coli* in the urine is given differently in the various statistics. L. STROMINGER (7) finds more than 90 % *Escherichia coli* in a material of 350 cases, in the remaining cases *Escherichia coli* and *Staphylococci*, and in 2 cases *Streptococcus faecalis* alone.

JUSTINA HILL (3) finds in a material of about 350 cases of infection of the urinary tract 53 % Gram + bacilli and 63.7 % Gram + cocci. Enterococci are not mentioned at all, and it seems reasonable to assume that the essential part of the Gram + cocci have been *Staphylococci*.

WALTHER THOMSON (8) also finds *Escherichia coli* to be the commonest urine finding in infections of the urinary tract. Next come *Proteus vulgaris* and *B. lactis aerogenes*. Other bacteria, such as *Streptococcus* and *Staphylococcus* are only rare findings in bacteriuria, according to the experience of these authors.

In order to have a Norwegian base for comparison we have collected the material that has been examined at Captain W. Wilhelmsen and Mrs. Wilhelmsen's Bacteriologic Institute of the University Hospital during the last 3 years. In a total of about 600 urine specimens we found about 65 % Gram + intestinal rods, of which *Escherichia coli* was the dominant one. In our material there was 16 % *Staphylococcus aureus* sive *albus*, whereas of *Streptococcus faecalis* only 7 % was found.

This picture of a pure intestinal flora characteristic to the postoperative condition in our opinion point to *the intestine* as the source from which the urine becomes infected. It would be of great practical importance to demonstrate the route by which the bacteria are transferred from the intestine to the urine.

### The Route of Infection

There are, as already mentioned, many theoretical possibilities for an infection of the urine after prostatectomy. The infection may pass through *urethra* alongside the permanent catheter, possibly under influence of enema treatment. It may take place via *the skin*, either with bacteria from the skin itself or with intestinal bacteria carried from anus to the skin by the patient's fingers. It may be transmitted by the *rubber tubes* and irrigational solution, or *during operation* enter by means of the surgeon's fingers, his instruments or from the air. It may further derive from the *prostate gland* or from a previously infected upper urinary tract. And finally, and in our opinion the most probable route, from the intestine through *blood and lymph* to the urine either via the kidneys, or directly through regional blood and lymph routes from rectum to bed of the wound in the prostate.

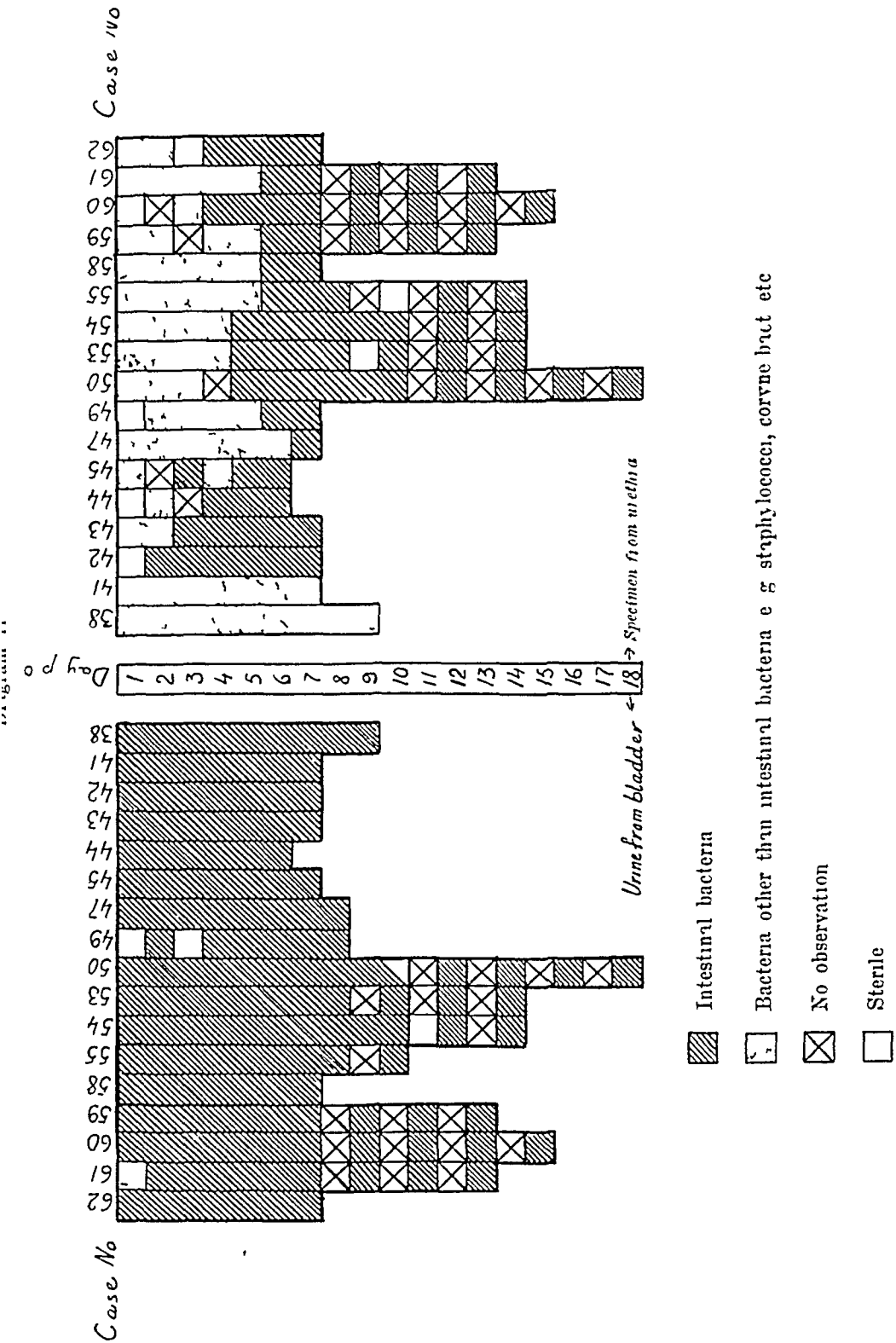
Our examinations, which proved to us that the infection in all cases is constant, rapid and consists of a pure intestinal flora, at once made it seem probable that it is not a question of several different and more accidental infectional routes, but of a single typical route of infection for all cases.

We chose the route through urethra and the one via the skin for our studies.

### Infection through Urethra.

According to our view it should be obvious that urethra would be the portal of entry in case the intestinal bacteria appear first here and later in the urine and thereafter remain constant in both places. But if the intestinal bacteria are found first in the urine and next in urethra and then remain constant in both places, then urethra may be put out of the question as the typical route of infection.

Diagram II shows clearly that urethra may be left out as typical infectional route for the intestinal bacteria. To the left are shown



the bacterial conditions in the urine, to the right conditions in urethria (fossa navicularis). The obliquely lined columns signify "intestinal bacteria", the blank ones sterile specimen, the dotted columns "bacteria other than intestinal ones" and the crossed columns "no specimen taken that day"

It is seen that the intestinal bacteria in all cases appear first in the urine and as a rule only much later in urethra. Once pointed out the intestinal bacteria remain constant in both places.

### Infection from the Skin.

Table III illustrates the relation between bacterial cultures taken simultaneously from skin and urine. It shows that the skin culture in no case gave growth of intestinal bacteria, but of Staphylococci, as was to be expected. The specimens are not

Table III

	Skin	Staph alb	Staph alb	Staph alb	Staph alb
55	Urine	0	E coli	E coli	E coli
	Skin	Staph alb	Staph alb	Staph alb	
58	Urine	0	E coli	E coli	E coli
	Skin	Staph + coryne	Staph	Staph	Staph
59	Urine	0	E coli Strept fecal	E coli Strept fecal	E coli Strept fecal
	Skin	Staph alb	Staph alb	Staph alb	Staph + B ale fecal
60	Urine	0	B Alcaligen fecal	B Alcaligen fecal	B Alcaligen fecal
	Skin	Staph alb	Staph alb	Staph alb	Staph alb
61	Urine	0	0	Strept fecal	Strept fecal
	Skin	Staph	Staph	Staph	0
62	Urine	0	E coli	E coli	E coli Strept fecal

The Table illustrates the bacterial condition in cultures taken simultaneously from skin and urine, and shows that the infection of the urine did not derive from the skin.

numerous, but they agree and indicate that the skin is no typical source of infection for the urine in the course following prostatectomy

The fact that the urine after prostatectomy rarely contains the commonest microbe of the skin, *Staphylococcus*, in the present examinations in 3 out of 34 cases only, might also well suggest that the infection of the urine does not travel by this route

### Infection from the Intestine through Blood and Lymph.

Many clinical and experimental experiences are favourable to the theory that *Escherichia coli* may be transmitted by the blood from the intestinal tract to the urinary system. This route of infection is even considered to be the main one in the infection of the urinary tract that HERTZ-BOYER (2) has called syndrome entero-renal. The bacteria may pass either through the blood only, or first through the lymph and then through the blood. In the latter case the bacteria are drawn into the minute lymphatic vessels of the intestine and pass through cisterna chyli into the blood. To demonstrate the bacteria in the blood is very difficult. M. FISCH (7) believes to have shown that the circulating blood has an antiseptic effect upon the bacteria, but when the bacteria become sufficiently numerous a general infection will set in and the blood cultures may become positive. For a successful result conditions are specially favourable when the patient is having chills.

Passage of the bacteria through the kidneys has also been demonstrated. H. VINCENT (9) has injected *Escherichia coli* into the marginal veins of rabbits' ears and has shown the bacteria in the urine three hours later. The passage has also been histologically proved, as glomeruli and tubuli were filled with colibacilli. The question has still not been answered whether the bacilli may pass the kidney without damaging the renal epithelium. In L. STROMINGER's large monography "La Colibacillose" a number of authors are quoted for or against passage of the colibacilli through the intact kidney.

However, there are also possibilities of a direct route for the voyage of intestinal bacteria from the intestine into the blood. This direct route consists of the regional blood and lymph vessels surrounding rectum and vesica. It is well known that anal and

rectal-sufferings such as hemorrhoids, injuries and inflammations of rectum, rectal stricture, fistulas and especially anal fissures are capable of producing prostatitis. This prostatitis possibly arises metastatically, but may also, in the opinion of several authors, be transmitted directly by the neighbouring blood and lymph vessels favoured by the venous spaces and the venous stasis that is characteristic to this region.

If this direct transmission of bacteria from the neighbourhood to an intact prostate may happen, this should also be possible to the bed of a prostatectomy wound, being favoured by the massage caused by the digital removal of the gland. Anyone who has performed a rectal amputation for cancer recti has had the opportunity to observe the close neighbourship of rectum and the prostate capsula. Imagining the prostate gland removed and the capsule possibly lesioned, there would not be much left to separate rectum from cervix of the bladder.

When in the present material we have found exactly the same microbes which have been pointed out by several statistics as the main ones in spontaneous infection of the urinary tract, if not in the same proportions, it seems reasonable to assume that also the infectional route would be the same one. If transmission takes place through the regional blood and lymph vessels this should account for such rapid and massive infection after this operation, in which the lesion on the prostate side is considerable, and in which also the rectal mucous membrane is exposed to forceful traumas. In these conditions penetration by the enterococci might supposedly be easier than under normal circumstances.

Considering the richly varied microbic flora of the intestine one might, in case of direct infection from the intestine by fecal contamination during the operation, at least in a few cases expect to find also other microbes than those common to infections of the urinary system. As such was not found in anyone of our 34 cases, we believe ourselves justified in assuming that the infection does not travel by this route.

In the present work we have been unable to contribute mentionably to solution of the problem of the bacterial transmission by way of the blood. The fact that 3 daily postoperative blood cultures in 10 cases, i. e. a total of 30 blood cultures were negative is not saying much, considering the difficulty in demonstrating the bacteria in the current blood.



8th day inclusively. Only 9th day *Escherichia coli* occurred. Considering the fact that not a single of our 34 cases of prostatectomy escaped intestinal bacteria as long as seven days, one might be permitted to conclude, in spite of the difference in the number of cases between prostatectomies on one side and cystostomy on the other, that there seems to be a difference in the bacterial invasion of the urine after prostatectomy and after cystostomy, a difference that possibly may be attributed to the trauma received by cervix vesicae.

### Cultures from the Prostate Gland.

In 35 cases cultures were made from the enucleated prostate gland. Growth appeared in 12 cases, no growth in 23 cases. In 2 of the cases the same bacterial type, *Escherichia coli*, was simultaneously found in urine specimen and in culture from prostate, and the possibility that the prostate section has been contaminated during the act of taking the smear can therefore not be excluded. However, in 10 cases the urine specimen taken simultaneously was sterile. In these 10 cases there were found Gram positive cocci, recognized as micrococci. These were examined according to the usual biochemical methods, which revealed these cocci not to be pathogenously significant.

Thus it seems that the prostate in a few cases contains bacteria which are not at the same time found in the urine. Whether these bacteria are pathogenous does not proceed from the present examinations.

Table V.

*Cultures from the prostate gland.*

No.	Histologic diagnosis	Growth	
		+	÷
18.	Adenoma prost. ....	5	13
5.	Hyperplasia prost. ....	2	3
2.	Fibroadenoma prost. ....		2
1.	Carcinoma prost. ....	1	
6.	Adenom prost. + <i>prostatitis</i> ....	2	4
2.	Hyperplas. prost. + <i>prostatitis</i> ....	1	1
1.	Sclerosis prost. + <i>prostatitis</i> ....	1	
25.		12	23

A comparison between the histologic diagnosis and the bacterial findings in the prostate shows no accordance, as the diagnosis prostatitis appears with no regularity, as well with as without the presence of bacteria in the prostate gland. From most of the preparations also Gram sections were made. Here it was found, in the preparations in which microbes had been discovered as well as in the others, formations that suggested microbes. But definitely to decide whether these were microbes, detritus, pigment granules or color sediments was not practicable. We were therefore obliged to give up these investigations.

### Bacteriologic Examination of Punctate from Epididymitic Exsudate.

The postoperative epididymitis is, as already mentioned, a rather frequent complication in those cases in which preliminary vasectomy has not been made. Occasionally with the epididymitis it appears an exudate in tunica vaginalis testis, and in rare cases there is abscess formation with necrosis of testis. These cases offer opportunity for bacteriologic examination of etiology of the epididymitis.

In the present series of prostatectomies abscess with necrosis of testis occurred in one case. The epididymitis was clinically demonstrable 10th day after the operation. 20th day after the operation the abscess was shown, and *puncture* with aspiration of pus was made. The 25th and 33d day the puncture was repeated. Later an incision had to be made and through this opening whole of the testis was gradually expelled.

All three punctates gave growth of *Pseudomonas Jægeri*, a bacteria that as far as is known has not formerly been proved pathogeneus in man. Serologic examinations revealed that the microbe was pathogenous in the present case.

This case is interesting, not only as a bacteriologic curiosum. Clinically it is of value that this case demonstrates that nothing may be concluded from the bacterial findings in the urine with regard to the bacteria that causes epididymitis. In the present case only *Escherichia coli* and *Streptococcus faecalis* were found in 13 continuous urine specimens. These bacteria were not found in the abscess, and the bacteria from the abscess, *Pseudomonas Jægeri* were not present in the urine.

A similar phenomenon has also been observed in a case of transurethral resection, outside the present prostatectomy material, in which the urine contained *Escherichia coli* only (a single specimen), whereas the epididymitic abscess contained yellow, hemolytic *Staphylococcus*

Thus it seems that the epididymitis is not due, or is not necessarily due to the bacteria in the urine, but that it derives from a different source, possibly urethra

### Importance of the Present Investigations to the Urologic Practice.

These investigations show that it seems impossible, even with a careful operational and postoperative technique to avoid infection of the urine already at a very early point of time after a prostatectomy.

The investigations further reveal that the rods found in the routine examinations after prostatectomy in most cases may be presumed to be colibacilli, and that the cocci found as a rule are not wound-bacteria, but fecal *Streptococci*. As the fecal *Streptococci* usually hardly are pathogenous, the finding of cocci in the urine after prostatectomy should as a rule be regarded as of no greater importance than the presence of rods

Thus the infection after prostatectomy may generally be regarded as a mild one compared to the infection by usual wound-bacteria. On the other hand, we know that *Escherichia coli* and *Streptococcus faecalis* both are capable of producing diseases in the urinary system as well as elsewhere in the human body. The diseases for which colibacilli may be held responsible have been summed up under the term "Colibacillosis". The colibacillosis has been the subject of intimate discussions in urologic literature of recent years. At the International Congress of Urologists in Madrid 1930 colibacillosis was a leading topic that occasioned a number of speeches. In STROMINGER's large monography "La Colibacillose" this subject has been dealt with at length. From the literature it appears that colibacillosis may take on various forms, partly general, septicchemical forms, partly local forms with inflammations in the various organic systems. Of such local forms there are diseases in the intestinal tract, in the liver and the gall ducts, in the lungs, in the endocrine

organs, in the kidneys and the urinary tract, in the nervous system and in the skin.

It thus seems that we have to take into account that every prostatectomy involves the patient in a special infection of shorter or longer duration, and which in many cases will show pathologic symptoms. This complication has to be put down to the debet side of the operation, and has to be thrown into the balance pro or contra an operation.

In order to obtain a general view of the pathologic symptoms which have to be allowed for as consequence of the postoperative infection we have summed up the postoperative complications.

It appears, as might have been expected beforehand, that epididymitis is the most frequent complication, found in 6 out of 33 cases (excluding 1 case in which preliminary vasectomy had been made). Epididymitis thus occurred in about 18 % of our cases, which approximately corresponds to the usual frequency in those cases of prostatectomy in which preliminary vasectomy has not been performed. From the fact that epididymitis may be prevented by preliminary vasectomy it should be permissible to conclude that this infection takes place per continuitatem. But, as already mentioned, we do not know whether it is caused by intestinal bacteria in the urine or by bacteria from urethra. The epididymitis should therefore not as a matter of course be considered a complication of the postoperative infection of the urine by the intestinal bacteria.

Second in frequency of the complications comes slight suppurations from the wound, that in no case was serious.

According to other investigations, especially French ones, *Escherichia coli*, besides causing local infections, shall also have toxic effects. STROMINGER relates that H. VINCENT is believed to have isolated 2 colitoxins, one an exotoxin that is supposed to be neurotrophic. The second an endotoxin that is enterotrophic. Against these toxins, especially the exogenous one, VINCENT has produced a serum that ostensibly is capable of having considerable effect. In a couple of our cases we have met with symptoms which by these authors are considered as typical to colibacillous toxic effect.

*Pain in back of the neck* is a symptom considered amongst the nervous complications of colibacillosis. M. DESGEORGES calls it "craquements douloureux de la nuque". In our case this

symptom appeared with rather severe pain and stiffness of the neck during the first days following the operation

*Transitory psychosis* occurred in one case of this series, and one of the authors has had the opportunity to observe an additional case after this series had been concluded. Before becoming aware to this clinical picture as typical for this special postoperative condition, the author has observed a case that has not been recorded in the patient's history. Possibly we are here faced with a complication attributable to bacterial toxins. In the present cases the condition appeared 3 days after the operation and lasted for 3 days. It started with restlessness that turned into auditory and visual hallucinations and distinct changes in character. It was typical that the patient before as well as after the period of confusion gave an impression of being perfectly normal.

*Case No 1* was a man, aged 66 years

<sup>15</sup>/<sub>6</sub> *Prostatectomy* The culture from the prostate showed growth of colibacilli and the urine contained colibacilli from the first day. <sup>20</sup>/<sub>6</sub> the patient's mind commenced to wander, he became restless and hallucinatory. From the same time there was a slight rise in temperature. <sup>20</sup>/<sub>6</sub> Ur + in blood 27 mg %. <sup>21</sup>/<sub>6</sub> the patient's mind gradually cleared and after this day he was psychically normal.

*Case No 2* Man, 69 years old

<sup>26</sup>/<sub>11</sub> *Prostatectomy* <sup>30</sup>/<sub>11</sub> Last evening the patient became highly restless and wanted to get out of bed. Then he had hallucinations. These were described by the patient partly as the picture of a nurse in white uniform passing through the room and leaving by the window, partly as small dolls dancing in the irrigator at the foot of the bed. Partly as a human head with luminous eyes peeping at him through an opening in the wall. This head talked to him. Besides many people crowded around his bed, but he could not get hold of them. He had the notion that somebody in the hospital was hypnotizing him. At times he felt like he was standing straight up and down in bed and that the room made a small turn, such that the window came into a different place. He was very cross and angry, and complained of various things concerning the nursing, as far as one could see without any reason.

The patient is afebrile. Ur + in blood 35 mg %

In the course of 3 days the physic disturbances disappeared, and the patient's mind was later normal as before.

The very transitory character of these conditions of physic confusion makes it probable that we here are faced with disturbances caused by poisoning with bacterial toxins. L. STROMINGER

reports several cases of psychosis in colibacillosis, and quotes other authors who have also observed psychosis in connection with acute pyelitis, appendicitis and other conditions caused by colibacilli. Some of these psychotic cases are claimed to have been cured by serum treatment.

Finally it should be mentioned a complication that has not been included in the Tables, just because it is so ordinary and in the first instance seems so little sensational, namely *fits of perspiration*, and especially in the form of *night perspiration*. According to our experience many prostatectomized patients complain of this symptom. This perspiration seems not to depend on the amount of fluid intake.

Also night perspiration is one of the symptoms given to be characteristic to colibacillosis. It is supposed to be specially due to the neurotrophic exotoxin. Possibly also in the postoperative condition with which we have been dealing an indication may be found of the toxic effect of the intestinal bacteria just in this "banal" symptom.

### Summary.

The authors have made bacteriologic investigation of the urine by daily examinations during the first 2 weeks after suprapubic prostatectomy, in a total of 34 cases. These examinations revealed that *Escherichia coli* and *Streptococcus faecalis* were predominant in the bacteriologic picture, *Escherichia coli* being represented in 32 cases and *Streptococcus faecalis* in 28 cases in all. Once demonstrated these bacteria later appeared in every one of the specimens. In 2 cases *Escherichia paracoli* and *B. alcaligenes faecalis* were found instead of *Escherichia coli*. For the rest *B. proteus* occurred in 5 cases, *Staph. aureus* in 3 cases and *Pseudomonas* in 1 case.

The examinations further showed that this infection of the urine by intestinal bacteria takes place very rapidly, even on careful asepsis. Already the first day after operation 24 of the urine specimens contained intestinal bacteria. 5th day all urine specimens showed intestinal bacteria.

Because the postoperative flora in the urinary tract practically exclusively is an intestinal one, the authors presume that focus of the infection is the intestinal tract.

With regard to the infectional route the authors believe that the regularity in types of the bacteria found justifies their drawing

the conclusion that as a rule there is one typical route of infection only carrying the postoperative infection of the urinary tract. This infectional route is supposed to lead from the intestine via blood and lymph to bed of the prostate. The authors have made some investigations that demonstrate that source of the infection is not likely to be urethra or the skin.

Bacterial cultures from the prostate gland gave inconstant findings and was positive no oftener in those cases in which in addition to adenoma there also was a prostatitis.

Finally the authors report 2 cases of postoperative transitory psychosis, presumably caused by bacterial toxins.

### Zusammenfassung.

Verff. haben durch tagliche Harnuntersuchungen in den ersten 2 Wochen nach suprapubischer Prostatektomie bei insgesamt 34 Fallen bakteriologische Untersuchungen des Harns ausgefuhrt. Diese Untersuchungen zeigten, dass im bakteriologischen Bilde *Escherichia coli* und *Streptococcus faecalis* vorherrschten, indem *Escherichia coli* im ganzen in 32 Fallen und *Streptococcus faecalis* in 28 Fallen vorhanden waren. Einmal nachgewiesen, erschienen diese Bakterien spater in jeder Probe. In 2 Fallen wurden *Escherichia paracoli* und *B. alcaligen faecal* an Stelle der *Escherichia coli* gefunden. Im ubrigen kam *B. proteus* in 5 Fallen vor, *Staph. aureus* in 3 Fallen und *Pseudomonas* in 1 Fall.

Die Untersuchungen zeigten ferner, dass die Infektion des Harns durch Darmbakterien sehr schnell stattfindet, selbst bei sorgfaltiger Asepsis. Schon am Tage nach der Operation enthielten 24 der Harnproben Darmbakterien. Am 5. Tage wiesen alle Harnproben Darmbakterien auf.

Da die postoperative Flora in den Harnwegen so gut wie ausschliesslich eine Darmflora ist, vermuten Verff., dass der Infektionsherd im Darmkanal liegt.

Was den Infektionsweg betrifft, glauben Verff., dass die Regelmassigkeit der gefundenen Bakterientypen zu der Schlussfolgerung berechtigt, dass es in der Regel nur einen typischen Infektionsweg fur die postoperative Infektion der Harnwege gibt. Von diesem Infektionsweg nimmt man an, dass er aus dem Darm auf dem Blut- und Lymphwege in das Prostatabett fuhrt. Verff. haben einige Untersuchungen ausgefuhrt, die zeigen, dass es un-

wahrscheinlich ist, dass die Harnrohre oder die Haut die Quelle der Infektion bildet

Bakterienkulturen aus der Prostata-drüse ergaben inkonstante Befunde und waren nicht häufiger positiv bei jenen Fällen, wo ausser dem Adenom auch eine Prostatitis vorhanden war.

Am Schluss berichten Verff über zwei Fälle von postoperativer, vorübergehender Psychose, die vermuthlich durch Bakterientoxine verursacht war

### Résumé.

Les auteurs, chez 34 malades, ont fait des examens bactériologiques journaliers des urines pendant les deux premières semaines après la prostatectomie suspubienne. Ces recherches révélèrent que l'*Escherichia coli* et le *Streptococcus faecalis* étaient les microorganismes prédominants dans le tableau bactériologique, le premier existant dans 32 des cas et le second dans 28 en tout. Une fois mises en évidence, ces bactéries apparaissaient ensuite dans chacun des échantillons d'urine. Dans deux cas on trouva l'*Escherichia paracoli* et le *B. alcaligenes faecalis* à la place de l'*Escherichia coli*. Pour le reste, le *B. proteus* fut reconnu dans 5 cas, le staphylocoque doré dans 3 et la *Pseudomonas* dans un.

Les examens montrèrent au surplus que cette infection des urines par des bacilles de l'intestin se produit très rapidement, même lorsque l'asepsie est rigoureuse. Déjà le premier jour après l'opération 24 des spécimens d'urine contenaient des bacilles de l'intestin. Au 5ème jour ils en montraient tous.

Le caractère exclusivement intestinal, en pratique, de la flore postopératoire de l'appareil urinaire fait présumer aux auteurs que le foyer d'infection n'est autre que le tractus intestinal.

Quant au cheminement de l'infection, les auteurs croient que la constance des types bactériens rencontrés justifie leur conclusion que, dans la règle, il n'y a qu'une seule voie typique par laquelle l'infection postopératoire gagne le système urinaire. Cette voie d'infection doit conduire de l'intestin, par les vaisseaux sanguins et lymphatiques, au lit de la prostate. Les auteurs ont fait certaines recherches qui démontrent qu'il y a peu de chances que la source de l'infection soit représentée par l'urèthre ou la peau.

Les cultures microbiennes faites à partir de la glande prostatique ont donné des résultats inconstants et n'ont pas été plus souvent

positives dans les cas où en plus de l'adénome il existait aussi de la prostatite

Pour terminer, les auteurs rapportent 2 cas de psychose post-opératoire passagère, probablement causée par les toxines bactériennes

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## Depressed and Comminuted Fractures of the Lateral Tibial Tuberosity.

By

VIKTOR VON BAHR

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Fractures of the lateral tibial tuberosity may be divided into three types, all of which are caused by an abduction violence to the knee joint

1) *The depressed, non-comminuted fracture* In this type of fracture the whole upper part of the lateral tibial tuberosity is pressed down. The actual articular surface is undamaged and the fracture enters the joint in the non-articular region of the tibial spine. This type, which is fairly benign, is relatively rare.

2) *The depressed, comminuted fracture* Here the lateral femoral condyle is pressed down into the lateral tibial tuberosity, crushing its articular surface. Anteriorly, laterally or posteriorly are usually found small marginal fragments which have not been depressed but which may be more or less widely separated.

3) *The non-depressed, "spreading" fracture* (Spaltbruch in German) In this type the lateral tibial tuberosity is split by pressure of the femoral condyle, and the lateral fragment is bent laterally. On the medial side of the resultant crevice between the fragments, the articular surface in these fractures is usually crushed and depressed. However, the crushing is often difficult to recognize on the roentgenograms.

The difference between the two last-mentioned fracture types is rather one of degree than species. Both may show separation of fragments and crushing of the articular surface. Furthermore, opinions vary as to what should be included in the "spreading" fracture group and in the comminuted fracture group.

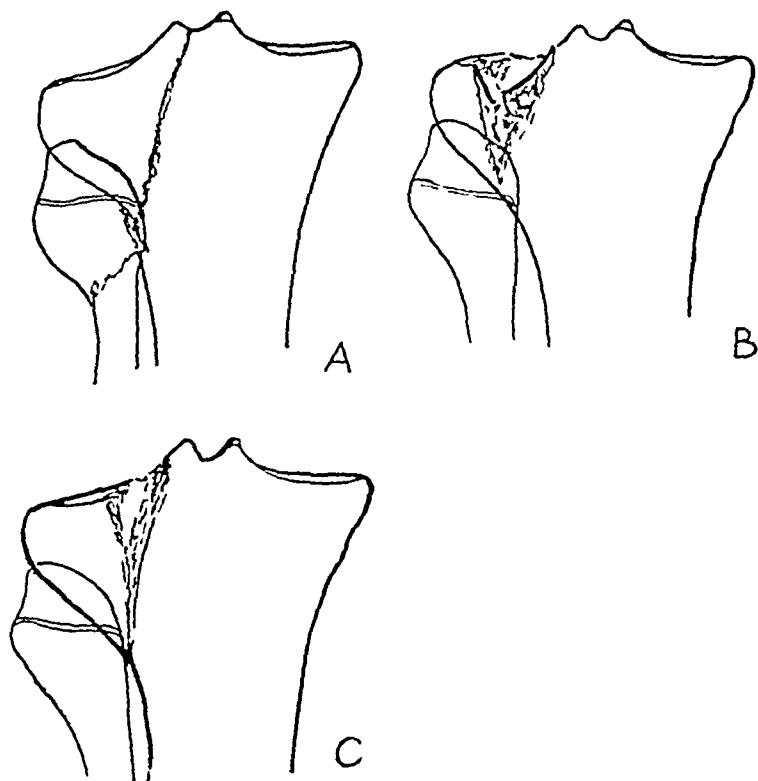


Fig 1 Sketches of the three types of fracture

- A Depressed non comminuted fracture
- B Depressed and comminuted fracture
- C Non depressed "spreading" fracture

From the points of view of therapy and prognosis, however, it is important to differentiate between these fracture types. In the "spreading" fracture the large part of the articular surface which belongs to the separated fragment is undamaged. The fragment can generally be put back into position without great difficulty. The small defect in the articular surface in the medial portion of the lateral tuberosity is of minor importance. The joint will be stable and the prognosis is generally good. Whether the fracture is treated entirely without operation or by attaching the separated fragment with, for example, a screw inserted horizontally is a matter of taste. In the depressed and comminuted fracture, on the other hand, the part of the articular surface on the non-depressed marginal fragments is too small for the function of the joint. As a rule the depressed parts of the articular surface cannot be replaced without operation. If the fragments are not replaced,

the result is often a permanent state of valgus in the knee joint and in some cases lateral instability also. The lateral instability may appear only with the knee flexed. The reason for this is that in some cases when the knee is extended the lateral femoral condyle rests on the non-depressed marginal fragments, in which case the stability of the joint is complete. Then, when the knee is flexed, the femoral condyle slips down into the depression in the tibial articular surface and the abnormal lateral movement occurs as a result.

It is therefore generally agreed that the prognosis is poorer for non-operated depressed and comminuted fractures than for non-comminuted, "spreading" fractures. Practically all surgeons also point out that depressed and comminuted fractures should be treated with arthrotomy and reduction.

For several years it has been the practice at Sabbatsberg Hospital to treat the comminuted fractures surgically. The subject of the present paper is the therapeutic results in the cases so treated from January 1, 1934, to December 31, 1940. The period of observation thus varied between three and a half and ten years. Patients operated upon after December 31, 1940, were not included, because the results of the treatment usually do not become stabilized until about three years have passed.

The following method, which has been described by PALMER, is generally used. The joint is opened with a lateral parapatellar incision, which is continued a few centimeters down the anterior aspect of the lateral tibial condyle. No attempt is made to expose possible longitudinal fractures with the incision, and the tibial surface is bared as little as possible. If damaged, the meniscus is extirpated.

As a rule even an uninjured meniscus must be detached near its anterior attachment, in order to provide a complete view of the damaged articular surface. At the end of the operation the meniscus is generally sewn into place again with a buried suture. In a few cases we removed the meniscus even though it was uninjured.

A hole is then chiselled through the cortex on the anterior aspect of the tibia a couple of centimeters below the articular surface. An elevator is passed through the hole into the spongy substance under the tibial fragments, which are then lifted up so that the appearance of the articular surface is as normal as possible. Despite the fact that the part of the articular surface forced into the head of the tibia is so often broken up into a number of

fragments, it is usually possible to achieve a smooth articular surface, perhaps with a few small defects left by detached pieces of cartilage. Sometimes, instead of chiselling a hole for the purpose, the elevator can be inserted through a fracture crack.

In order to fix the elevated fragments in place, we generally filled the resultant defect under them with *os purum* (*Os purum* consists of beef bone freed from fat and protein by a special process). In 1940, however, we began to use for this purpose a bone graft from the crest of the ilium, since in other operations *os purum* proved not to heal into place as well as autotransplants. Although in these knee operations *os purum* had no adverse effect on the healing, autotransplants do provide firmer support for the fragments than the other softer material.

If the marginal fragments are separated, they are pressed together manually. Occasionally during the past few years we attached the fragments with a screw inserted horizontally. If that is done it is sometimes unnecessary to pack bone under the elevated fragments, because the pressure from the sides provides the necessary support. The knee is then put in a plaster cast for two to six weeks. Thereafter active exercises are instituted, often under water to begin with. As a rule, weight-bearing is permitted after three months.

Between 1934 and 1940, about 120 fractures of the tibial condyle were treated at Sabbatsberg Hospital in Stockholm. This figure does not include fractures of the tibial spine only or other minor avulsion fractures. Among these 27 cases of depressed and comminuted fractures through the lateral tibial tuberosity, 15 males and 12 females, were reduced surgically. Three of these 27 patients could not be traced for the present after-examination. The remaining 24 cases will be discussed in the following.

In three of the cases ankylosis developed in the injured knee, and I shall begin by describing these failures.

*Case 1* (Fig. 2) A man of 56 years had a very severe compression fracture of the lateral tibial condyle combined with a fracture through the metaphysis. In this case the joint was widely opened by a Tector incision. The fracture was reduced and the fragments attached with a screw and wire through a bored canal. The dislocation was not entirely corrected. The convalescence was complicated by infection, with osteoarthritis and ankylosis as the final result.

*Case 2* (Fig. 3) A man of 37 years had a very severe compression fracture. The depressed fragments were lifted up and the defect be-

neath them filled with os purum. The head of the tibia was encircled with a loop of wire for reinforcement purposes. The dislocation was not entirely corrected. The joint was deformed by permanent valgus and abnormal lateral instability. Attempts to cure the condition with knee bandages of various kinds were made, but finally arthrectomy was done four and a half years after the accident.

Both these cases are examples of very severe compression fractures with extensive crushing of the lateral tibial tuberosity. It was not possible to operate according to the simple method described above, more complicated interventions with greater exposure of the fragments being required.

It is probably wiser in severe fractures of this kind not to operate at first, but to be content with bloodless reduction for the time being. When two or three months have passed and the fracture has become consolidated, the patient can be operated upon secondarily according to HULTÉN, if the results of primary reduction have proved unsatisfactory. The compressed fragments of the articular surface can then be loosened with a chisel to the point where they can be prized up into their rightful position. They can then be bolstered up with suitable bone grafts.

*Case 3.* A woman of 56 had suffered a comparatively mild compression fracture which was reduced in the manner described above with a good anatomic result. However, after two months of fixation it was found impossible to mobilize the knee again. Even the slightest movements elicited severe pain. Finally, after a long period of mobilization treatment, arthrectomy was done. The patient was heavily insured, and it may be that her desire for compensation contributed to the failure of the treatment.

I examined the remaining 21 patients both clinically and roentgenologically three and a half to ten years after the accident. Most of them were operated upon within a week of the accident.

Permanent *valgus* of less than five degrees was found in three cases.

All the injured knees could be *extended* 180 degrees, but in five cases extension was somewhat less than in the uninjured knee, in which some degree of hyperextension was possible. In one case the injured knee could be hyperextended five degrees.

The power of *flexion* in the injured knee joints compared with the healthy appears from figure 4. It will be seen that flexion was generally somewhat limited, but was perfectly satisfactory in the majority of cases.

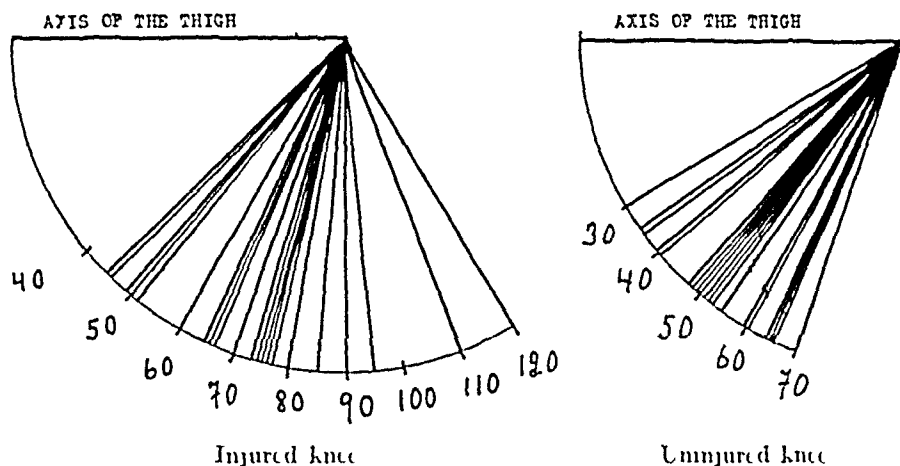


Fig 4 Diagram showing the angle to which the patients given after examination were able to flex the knee joints

*Abnormal lateral mobility.* abduction or adduction were not present in any case

*Increased forward mobility of the tibia on the femur* was present in five cases, in all of them to a very slight degree. This sign was probably not due to rupture of the anterior crucial ligament in any of the cases

STUMPFREGER stated that the lateral meniscus may easily grow to the lines of the fracture in the tibial articular surface. He believed that in this way the rotation of the tibia is limited, which in turn leads to trouble in the knee and ankle joints. This opinion, however, is not borne out by the present material. I was unable to find limitation of rotation of the lower leg in more than *two of the 12 cases* in which the meniscus was left in place, while rotation was restricted in *four of the nine cases* in which the meniscus was removed. As a rule the meniscus was only removed in the event of primary damage which in turn was most often found in cases of severe fractures. Consequently, it is probable that the restricted rotation depended more upon the type of fracture than on the presence or absence of the meniscus. In only one case did the patient complain of mild symptoms from the ankle, which might have resulted from the limited power of rotation of the leg.

As mentioned above, the meniscus when intact was severed at its anterior insertion, in order to provide a view of the fracture, and then sutured in place again at the completion of the operation.

When the after-examinations were made, none of the patients showed signs indicating a disturbance in the function of the sutured meniscus. Mostly in view of STUMPFEGGER's report that the meniscus if left in place will cause trouble, we have made a habit of removing it since 1940.

The after-examinations revealed that it is at least unusual for a meniscus left in place to cause trouble. The meniscus is undoubtedly of great importance in order to counteract the incongruity between the articular surface of the femur and the damaged and often somewhat deformed articular surface of the tibia. Consequently, there seems to me to be good reason to return to the earlier operative method with suturation of the meniscus wherever this is possible.

Of particular interest is the extent to which arthrosis deformans developed following the injuries under discussion. Any form of articular dysfunction or irregularity in the articular surface is believed to cause a disposition to arthrosis. However, the individual sensitivity seems to vary greatly in this respect. A study of the roentgenographic material from this point of view reveals that the incidence of arthrosis deformans depends to a great extent on whether any dislocation remains after reduction of the fracture (table I).

Table I

*Position of fracture following reduction*

		Roentgenologically demonstrable arthrosis deformans		
		None	Mild	Moderate
Good		6	3	—
Slight	dislocation	3	4	2
Moderate	»	—	2	1

In the cases in which there was still dislocation of the fragments following reduction, the bone had in general been greatly crushed and the fragments extensively dislodged. In this type of case, one must reckon with the possibility of some of the bone fragments becoming necrotic. The irregular, coarsely reticular design of the bone often to be seen in these cases is probably due to necrosis of this kind and resultant degenerative processes. No real reduction in the thickness of the articular cartilage compared with the other knee could be observed in any of the cases, which might well mean that the articular cartilage had not become necrotic, or at least not to any great extent.

In the above table I classified as arthrosis deformans cases exhibiting marginal deposits and exostoses on the articular surfaces of the joint but not changes confined to the damaged lateral tibial condyle. Clinically, the signs consisted of some thickening of the capsule and usually mild or fairly pronounced crepitations upon movement. In no cases was there exudation in the joint or increased skin temperature.

In appraising the functional results of the follow-up examinations, I divided the patients into three groups, according to HIRSH's classification (table II)

- Group I* Good function. The patients are cured and show only very insignificant changes.
- Group II* Less satisfactory function. The patients exhibit certain signs of insufficiency upon exertion, but are able to carry on their work as usual.
- Group III* Poor function. The patients are incapacitated.

Table II

*Position of fracture after reduction*

	Good Group I	Function Less good Group II	Poor Group III
Good	8	1	1
Some dislocation	7	2	—
More pronounced dislocation	1	2	2

Here, too, we find that the functional result depends greatly on the reduction of the fracture, but good functional results were secured even in the presence of mild permanent dislocation.

If the patients are grouped according to age, it will be found that this factor also is of great importance to the final result (fig. 5).

*Conclusions.* This investigation reveals that surgical treatment of the fractures under discussion generally gives a satisfactory result. The functional result is highly dependent on the position of the fragments secured in reduction of the fracture. Arthrotomy as such undoubtedly seldom has a bad effect on the prognosis of the fracture, and it is certain that a good position can not often be achieved without arthrotomy.

In very severe comminuted fractures it is perhaps wise to postpone arthrotomy until the fracture has become consolidated.



Fig 2  
Case 1



Fig 3  
Case 2

a



b



c



Fig 6 Woman, 40 years

a On admission

b Following reduction and insertion of "os purum"

c Seven and a half years later Mild arthrosis deformans Insignificant reduction in the thickness of the articular cartilage compared with the other knee Good function (Group I)

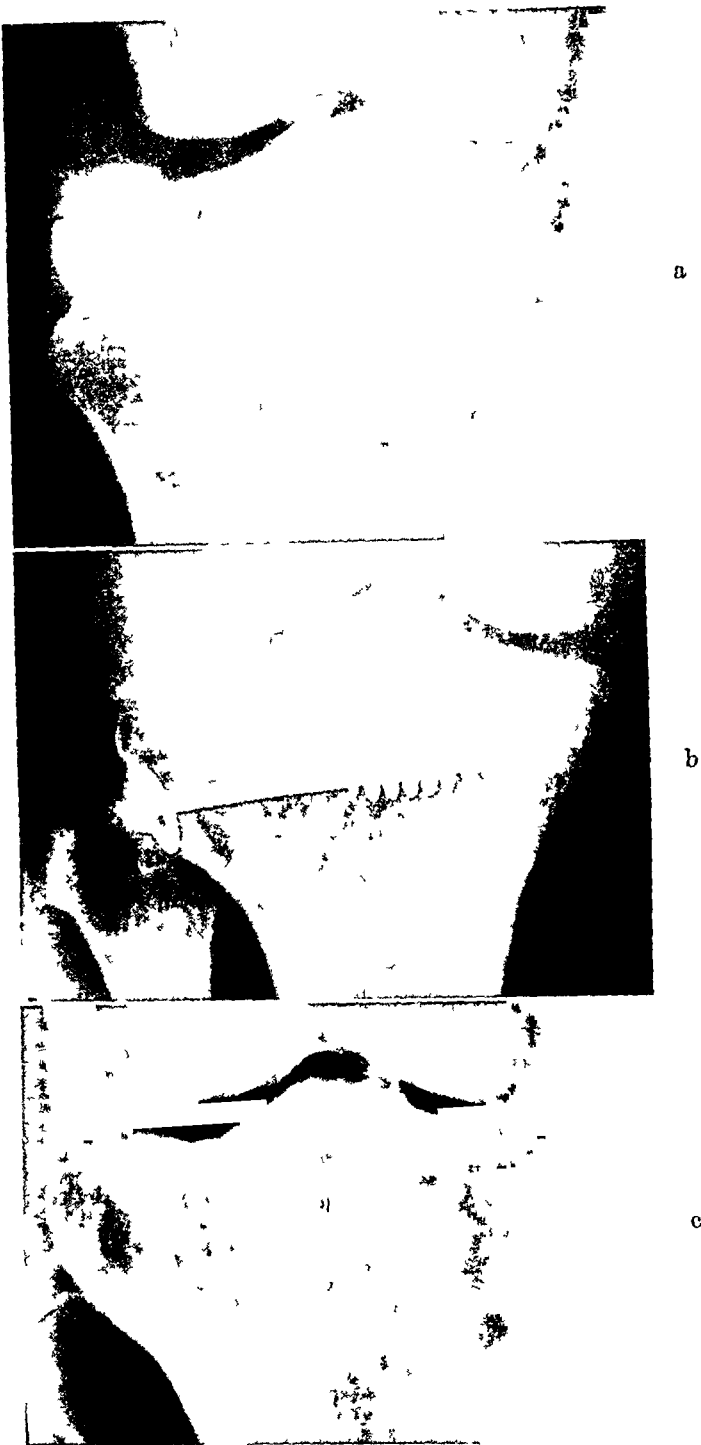


Fig 7 Woman, 26 years

- a On admission
- b Following surgical reduction and fixation with screw
- c Three and a half years later The bone structure of the lateral tibial tuberosity is somewhat coarsely reticular there are no signs of arthrosis deformans Less satisfactory function (Group II) (The screw was removed half a year after insertion)

a



b



c



Fig 8 Woman, 35 years

a On admission

b Following reduction and insertion of "os purum" Some depression of the articular surface still remaining

c Four and a half years later Irregular, coarsely reticular design of the bone in the lateral tuberosity No arthrosis deformans Less satisfactory function (Group II)

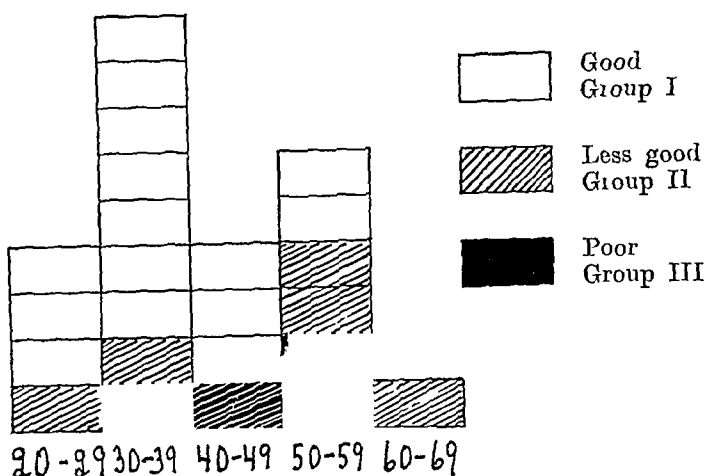


Fig 5 Functional results

Patients divided into age groups

### Summary.

Twenty-four cases of depressed and comminuted fractures of the lateral tibial tuberosity, treated at Sabbatsberg Hospital in Stockholm between 1934 and 1940, were submitted to after-examination three and a half to ten years after the injury

In these cases arthrotomy was followed by elevation of the depressed fragments, usually with the help of an elevator introduced through a chiselled canal under the fragments. The latter were fixed in place by the insertion under them of bone grafts or os purum and in occasional cases by screws or wire sutures also.

Ankylosis of the knee joint developed in three cases, in two of them following arthrectomy and in the third due to an infection. None of the other patients were incapacitated. The injuries healed without any real malposition and with full stability and usually good mobility in the joint. Of the 21 patients after-examined in which the knees were mobile, twelve exhibited arthrosis deformans, which was mild in nine cases and somewhat more pronounced in three.

### Zusammenfassung

24 Fälle von Kompressionsfraktur durch den lateralen Tibiakondylus, die in den Jahren 1934—1940 im Krankenhaus Sabbatsberg in Stockholm behandelt waren, wurden 10—3½ Jahre nach der Verletzung nachuntersucht.

Nach Arthrotomie waren die hinabgedruckten Knochenfragmente gehoben worden, gewöhnlich mit Hilfe eines Elevatoriums das durch einen gemeisselten Kanal unter die Fragmente eingeführt worden war. Dieselben waren darauf durch Pfropfung mit Knochentransplantat oder *Os purum* fixiert worden, in einigen Fällen auch mit einer Schraube oder einer Stahldrahtnaht.

3 Kranke hatten eine Kniegelenksankylose bekommen, in zwei Fällen nach Gelenkresektion, in einem infolge einer Infektion. Keiner der übrigen Patienten war invalidisiert. Sie waren ohne wesentliche Fehlstellung und mit voller Festigkeit sowie zumeist mit guter Beweglichkeit im Gelenk geheilt. Unter den 21 Patienten, die nachuntersucht wurden und bewegliches Knie aufwiesen, wurde Arthrosis deformans in 12 Fällen beobachtet, und zwar leichten Grades in 9 Fällen und etwas schwereren Grades in 3 Fällen.

### Résumé.

Vingt-quatre cas de fracture par compression interessant les tubérosités latérales du tibia, traites à l'Hôpital de Sabbatsberg entre 1939 et 1940, ont été reexaminés de 10 à 3½ ans après l'accident.

A la faveur d'une arthrotomie les fragments osseux abaissés ont été relevés, d'ordinaire avec un élévateur introduit dans un canal creusé au ciseau sous les fragments. Ceux-ci, ensuite, ont été fixés en place par tassement de greffons osseux ou de morceaux d'*os purum*, et dans certains cas aussi ils l'ont été par une vis ou une suture métallique.

Trois malades ont gardé une ankylose du genou, deux fois après résection de cette jointure, une fois du fait d'une infection. Aucun des autres n'a reçu de rente d'invalidité. Ils ont tous guéri sans déformation importante, avec une stabilité complète du membre et, dans la règle, une bonne mobilité articulaire. Sur les 21 sujets réexaminés qui avaient un genou mobile on a constaté de l'arthrose déformante dans 12 cas, 9 fois légère et 3 fois un peu plus accentuée.

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# Zur Frequenz des Magen- und Duodenalgeschwürs in Schweden während der Kriegsjahre.

Von

GUSTAF PETREN,

Lund

Die Anzahl der Fälle von Ulcus die in den medizinischen Abteilungen schwedischer Krankenhäuser zur Aufnahme und Behandlung kommen hat während der letzten Jahre, der Kriegsjahre an manchen Orten zugenommen. Einige Zahlenangaben mögen dies beleuchten. Nach SÄLLSTRÖM<sup>1</sup> (März 1913) hatte zwar das Ulcusmaterial des Stockholmer *Sciaphimerkrankenhaus* während der ganzen Zeitspanne von 1930—1912 zugenommen — in der fraglichen Zeit wurden am Sciaphimerkrankenhaus etwa 2,500 Ulcusfälle diagnostiziert, von denen etwa 650 in die medizinische Klinik aufgenommen worden waren in den Jahren 1930—32 waren es etwa 100 Fälle pro Jahr in den Jahren 1933—35 etwa 150 jährliche Fälle, 1936—41 etwa 200 Fälle, und 1912 trat eine stärkere Steigerung auf über 300 Fälle ein. In der med. Klinik zu *Lund* sind laut den Jahresberichten in den Jahren 1937—39 durchschnittlich 156 Ulcuspatienten pro Jahr behandelt worden, im Jahre 1942 waren es 174 Fälle und im Jahre 1943 193, somit eine massige Steigerung. Für die medizinische Abteilung des *Malmöer* Krankenhauses geben die Jahresberichte entsprechend folgende Zahlen 168, 215 und 254, somit eine erheblichere Zunahme besonders im Jahre 1943. Die medizinische Abteilung des *Hälsingborger* Krankenhauses versorgte nach GOHL<sup>2</sup> (Juni 1943) in den

<sup>1</sup> Diskussionsbeitrag (schwedisch), Nord. Medicin Bd 23, S 1405 1944

<sup>2</sup> O. GOHL, Ulcusleiden und Krisenzeit (schwedisch), Nord. Medicin Bd 23, S 1537

Jahren 1937—39 durchschnittlich 107 Ulcusfälle pro Jahr, 1941 waren es 127 und 1942 160 Fälle, also auch hier eine recht beträchtliche Steigerung. Die gleiche Erfahrung ist an der med. Abteilung des Krankenhauses in *Orebro* gemacht worden, im Jahresbericht für das Jahr 1943 schreibt MALMROS »Die Krisenzeit hat auch auf andere Weise ungünstig auf die Volksgesundheit eingewirkt, die Zahl der Magenleiden hat zugenommen.«

Eine ganze Reihe von Kollegen ist zu der Auffassung gelangt, dass diese gesteigerte Anzahl von Ulcuspatienten in vielen unserer Krankenhäuser während der letzten Jahre nicht restlos damit erklärt wird, dass zahlreiche Kranke mit Magengeschwüren wahrscheinlich eher geneigt sind, in diesen Zeiten mit ihren besonderen Ernährungs- und Diät Schwierigkeiten daheim sich der Krankenhauspflege anzuvertrauen, sondern dass diese Zunahme auch und vielleicht im wesentlichen Grade auf einer echten Steigerung der Ulcusfrequenz unter der schwedischen Bevölkerung beruhe. Auch hat man verschiedentlich Sektionsserien, die für die letzten Jahre einen erhöhten Prozentsatz von Ulcusbefunden im Gesamtabduktionsmaterial der betreffenden Krankenhäuser ausweisen, als Stütze für die Ansicht aufgeführt, dass die Magen- und Duodenalgeschwüre heute häufiger sind als früher.

Ferner ist in bezug auf das Ulcus in der letzten Zeit diskutiert worden — auch auf Kongressen schwedischer Internisten und Röntgenologen —, ob nicht das Ulcusmaterial in den letzten Jahren Veränderungen nicht bloss hinsichtlich der Frequenz, sondern auch in anderer Beziehung aufgewiesen habe. So was die Lokalisation des Ulcus betrifft, die Magengeschwüre, besonders im *Corpus ventriculi*, sollen nach der Erfahrung mehrerer — doch keineswegs aller — Autoren RODHE<sup>1</sup> (Stockholm), ÖHNELL<sup>2</sup> (Stockholm), GOHLE (Helsingborg), ROTHE<sup>3</sup> (Essen), BRUHL<sup>4</sup> im Verhältnis starker zugenommen haben als die Zwölffingerdarmgeschwüre, so dass also eine gewisse Verschiebung im Sitz des Geschwüres festzustellen wäre, und zwar vom Duodenum zum Magen hin, ganz im Gegensatz zu der Tendenz, die hinsichtlich der Ulcuslokalisation im grossen ganzen während der letzten 25—30 Jahre zu

<sup>1</sup> G. RODHE, Hat die Krisenzeit auf den Sitz der Magengeschwüre eingewirkt? (schwedisch), Nord Medicin, Bd 23, 1944, S. 1405.

<sup>2</sup> H. ÖHNELL, Diskussionsbeitrag (schwedisch) Ebda, S. 1406.

<sup>3</sup> H. ROTHE, Zunahme der Magen- und Zwölffingerdarmgeschwüre im Kriege? D. med. Wschr. 1941, II, S. 810.

<sup>4</sup> W. BRUHL, Die Behandlung des Ulcus und der Gastritis im Kriege. Klin. Wschr. 1942, S. 951.

beobachten war<sup>1</sup> Ferner haben Röntgenuntersuchungen in einigen Krankenhäusern MALMROS,<sup>2</sup> GUTZEIT<sup>3</sup> (Breslau) für einen Teil der Fälle grossere Nischen festgestellt, als man sie früher zu sehen pflegte. Mehrere Internisten meinen auch bestimmt festgestellt zu haben, dass ein Teil der Geschwüre in den letzten Jahren weit schlechter heilten und längere Behandlung erforderten als vor der kriegsbedingten Krisenzeit. In diesem Sinne berichten SALLSTROM (a a O) aus dem Seraphimekrankenhaus, LJUNGDAHL<sup>4</sup> Malmö, MALMROS Örebro (a a O), letzterer schreibt 1913 »Während des letzten Jahres hat es sich oft als sehr schwer erwiesen, mit der gewohnten inneren Behandlung ein Magengeschwür zu heilen.«

Es sind also auch in Schweden etliche das Ulcusleiden betreffende Fragen während des zweiten Weltkrieges aktuell geworden, und zwar in erster Linie die Frage der Frequenz. Die Schwierigkeiten, die sich einer wirklich exakten Ermittlung aller Ulcusfälle in einer grosseren Bevölkerung, z. B. der Bevölkerung der Stadt Malmö oder der Prov. Schonen, in den Weg stellen, sind aus naheliegenden Gründen unüberwindlich, und zwar wegen des wechselnden Symptomenbildes der Ulcuskrankheit, wegen der Unsicherheit der Diagnose in vielen Fällen, auch in einer Reihe von Fällen mit Röntgenuntersuchung, u. a. m. Die Beobachtungen und Erfahrungen einzelner Krankenhausärzte oder Privatpraktiker über die Anzahl der zur Beobachtung gekommenen Ulcusfälle in dem betreffenden Krankenhaus bzw. der eigenen Praxis mögen von verschiedenen Gesichtspunkten aus grosses Interesse besitzen und selbstverständlich auch von Wert für die Frage der Frequenz sein, doch genügen sie nicht, um das Problem der Häufigkeit klarzulegen. Es dürfte überhaupt nicht möglich sein, auch nur annähernd zu ermitteln, wie viele Menschen der Gesamtbevölkerung einer grosseren Stadt oder einer Provinz gegenwärtig an Magen- oder Darmgeschwüren leiden.<sup>5</sup>

<sup>1</sup> Siehe hierüber z. B. I. HOLMGRÉN, Einige Zahlen über Magengeschwüre aus dem Seraphimerkrankenhaus (schwedisch) Svenska Läkaresällskapets Förhandlingar, 1936, S. 271, G. ALSTED, Die Diagnose und Behandlung des Ulcusleidens (dänisch), Ugeskrift for Læger, Bd. 102, S. 587, sowie B. J. E. IHRE und R. MÜLLER, Gastric and duodenal ulcer, Acta med. scand. Bd. 116, 1943, S. 33.

<sup>2</sup> H. MALMROS u. R. BJÖRLIN, Der Einfluss der Krisenzeit auf die Heilung der Magengeschwüre (schwedisch), Sv. Lakart 1943, S. 1669.

<sup>3</sup> NICH. H. HULTS Referat des Kongresses für innere Medizin in Wien, Okt. 1943 (schwedisch) Sv. Lakart 1944, S. 606.

<sup>4</sup> Äusserung in Sydsvenska Dagbladet vom 18. Juli 1943 (schwedisch).

<sup>5</sup> In seiner Dissertation Veränderungen im Auftreten des Ulcusleidens, durch eine neue sektionsstatistische Methode beleuchtet (dänisch), Kopenhagen 1943, vertritt JENS L. HANSEN den Standpunkt, es sei möglich, an Hand von Sektionsmaterial, das die Fälle sowohl mit »akzidentellem« als mit »essentiellem« Ulcus

Dagegen stellen die *Perforationsfälle* im Ulcusmaterial einer Bevölkerung — wenigstens einer schwedischen Bevölkerung — eine Gruppe dar, deren Anzahl sich wenigstens für die letzte Zeit approximativ ziemlich gut feststellen lässt. Dies aus folgendem Grunde. Bei der Einstellung der heutigen Ärzteschaft und dank den durch den Motor verbesserten Verkehrsmöglichkeiten (auch für Krankenwagen) kann man recht sicher sein, dass, wenn nicht jeder, so doch fast alle Perforationsfälle, mit ihrem sturmischen Symptomenbild, in Schweden jetzt und auch während der letzten 10—15 Jahre in das nächste Krankenhaus geschafft und dort mit nur ganz wenigen Ausnahmen operiert worden sind. Durch eine Zusammenstellung der Angaben über die Anzahl der operierten Fälle von *Ulcus perforans aller* schwedischen Krankenhäuser und Kliniken, privater wie öffentlicher, in denen derartige Operationen überhaupt vorgenommen werden, kann man Zahlen über die Frequenz der Perforationsfälle in Schweden von Jahr zu Jahr während der letzten Zeit erhalten, die sicherlich den wirklichen recht nahe kommen. Vollig exakt werden indessen diese Zahlen nicht sein, da man damit rechnen muss, dass in ganz vereinzelt Fällen von *Ulcus perforans* kein Arzt geholt oder keine Diagnose gestellt worden ist, dass in anderen vereinzelt Fällen weite Entfernungen und schwierige Transportverhältnisse, besonders in Nordschweden, eine Verbringung ins Krankenhaus unmöglich gemacht haben, oder dass auch dieser oder jener Fall in solch hoffnungslosem Zustand ins Krankenhaus gelangte, dass eine Operation für zwecklos gehalten wurde und deshalb unterblieben ist. In einer früheren Arbeit<sup>1</sup> habe ich eine solche Untersuchung über

umfasst, approximativ die Frequenz des Ulcusleidens in einer Bevölkerung zu berechnen. G. ALSTED macht in einem 1942 erschienenen Aufsatz *Die Erscheinungsformen des Ulcusleidens in der dänischen Bevölkerung (dänisch)* (Ugeskrift for Læger, Bd 104, 1942, S. 325) gewisse Angaben über die Ulcusmorbidity in der dänischen Bevölkerung, die sich auf eine Erhebung mittels Fragebogen der Gesundheitsbehörde an sämtliche praktischen Ärzte Danemarks betreffs aller im Oktober 1940 beobachteten Ulcusfälle stützt (75 % der Ärzte hatten geantwortet). Es wurden 4,159 Ulcusfälle gemeldet, 3,113 betrafen Männer, 1,046 Frauen, was 11 Ulcusfällen pro 10,000 der dänischen Bevölkerung entspricht, 16,8 pro 10,000 der männlichen und 5,4 Ulcusfälle pro 10,000 der weiblichen Bevölkerung. Ferner macht er Angaben über die Verteilung der Fälle auf die einzelnen Altersgruppen, nach Geschlechtern getrennt, u. a. m., und man erfährt auch, dass von sämtlichen 4,159 Fällen nur 629 im Oktober 1940 *erstmalig* wegen ihres Ulcus in Behandlung waren. Die Untersuchung hat mit den darin vorgelegten Zahlen ein erhebliches Interesse, doch gibt sie keine bestimmteren Anhaltspunkte für die Beurteilung der jährlichen Ulcusmorbidity in Danemark, die selbstverständlich weit grösser ist, als es die Zahlen der Untersuchung für 1 Monat angeben, andererseits aber keineswegs auch nur annähernd 12mal grösser.

<sup>1</sup> G. PETRÉN, Über die Frequenz der Ulcusperforationen in Schweden und den einzelnen Provinzen während der dreissiger Jahre (schwedisch) Sv. Lakar.

die Anzahl der in den Jahren 1930—40 in Schweden operierten Fälle von *Ulcus perforans* vorgelegt, gestützt teils auf die Angaben der im Druck vorliegenden Jahresberichte der betreffenden Krankenhäuser, teils auf schriftlichen Bescheid der Ärzte an allen denjenigen Krankenhäusern usw., deren Jahresberichte nicht gedruckt sind. Ich habe nun genau nach denselben Richtlinien diese Untersuchung über die Frequenz des *Ulcus perforans* in Schweden auch für die letzten drei Jahre, die Kriegsjahre 1941—43, fortgesetzt. Nach dem oben Gesagten ist es klar, dass es sich bei den in diesen beiden Untersuchungen zusammengestellten und vorgelegten Zahlen um *Mindestzahlen* handelt, und zwar *vielleicht* in etwas — sicherlich nur geringfügig — höherem Grade betreffs der ersten Jahre des dritten Jahrzehnts als betreffs der ersten Jahre des vierten Jahrzehnts, da wenigstens die Möglichkeit vorhanden ist, dass vor 12—14 Jahren verhältnismässig mehr *Perforans*-Fälle nicht in den Operationszusammenstellungen vertreten sind als in den letzten Jahren, und zwar teils infolge des möglicherweise etwas zurückgebliebenen Standpunktes, den der eine oder andere der damals noch praktizierenden älteren Ärzte hinsichtlich der akuten Bauchfälle einnahm, teils auch infolge der damals noch nicht so vollkommenen Transportmöglichkeiten, wie sie heute gegeben sind. Die Gesamtzahl der Fälle von *Ulcus perforans* in Schweden wird also während dieser 14 Jahre *etwas* — wie sehr dürfte sich nicht mit Bestimmtheit beurteilen lassen — meiner Ansicht nach aber nicht sehr über den in Tab. I angegebenen Zahlen der operierten Fälle gelegen haben.

Tabelle I

Anzahl der in den Jahren 1930—43 in Schweden operierten Fälle von *Ulcus perforans*

Jahr	Operiert wurden	Davon starben	Postoperative Mortalität
1930	425	91	21 4 %
1931	482	99	20 5 %
1932	446	89	20 0 %
1933	445	92	20 7 %
1934	492	92	18 5 %
1935	526	98	18 6 %
1936	573	95	16 6 %

tidning 1942, S. 1829. In diesem Aufsatz sind die kleineren Fehlerquellen, die der Untersuchung inhaften oder anhaften können, eingehender angegeben. — Auch in »Der Chirurg«, Bd. 14, 1942, S. 705.

Jahr	Operiert wurden	Davon starben	Postoperative Mortalität
1937	512	106	20 7 %
1938	567	107	18 9 %
1939	584	106	18 2 %
1940	633	124	19 6 %
1941	626	98	15 7 %
1942	863	113	13 1 %
1943	731	102	14 0 %
Zusammen	7,905	1,412	

Über die *Mortalität* nach Operationen wegen *Ulcus perforans* in Schweden, eine Frage, die in meinem vorigen Aufsatz näher abgehandelt ist, sei hier nur ganz kurz gesagt, dass sie, wie die Tabelle zeigt, im Laufe dieser letzten 3 Jahre erfreulicherweise weiter zurückgegangen ist. Während die Mortalität in den vorhergehenden 10 Jahren im grossen ganzen zwischen 18 und 20 % betrug, ist sie in den letzten 2 Jahren auf 13—14 % zurückgegangen. Eine gewisse Rolle spielt für diese verminderte Mortalität wahrscheinlich die in den letzten Jahren verhältnismässig höhere Anzahl der Männer, besonders jungerer Männer, unter den Perforationsfällen. Zweifellos aber ist die immer frühzeitigere Einweisung der *Ulcus-perforans*-Patienten in die Krankenhäuser und die dadurch ermöglichte frühere Operation der Fälle die wesentlichste Ursache dessen, dass immer mehr von denen, die an dieser unmittelbar lebensbedrohenden Ulcuskomplication erkranken, mit dem Leben davonkommen.

In Tabelle II ist die jährliche Frequenz an operierten *Ulcus-perforans*-Fällen, auf je 100,000 der schwedischen Bevölkerung berechnet, für jedes einzelne Jahr angeführt,<sup>1</sup> in Tabelle III sind die entsprechenden Durchschnittszahlen für je 2 Jahre der 14 untersuchten Jahre angegeben.

<sup>1</sup> Beiläufig sei hier bemerkt, dass eine von J. VARNEK nach ähnlichen Gesichtspunkten durchgeführte Untersuchung über die Anzahl der Fälle von *Ulcus perforans* in ganz Dänemark während der Jahre 1922—38 (Ugeskrift f. Læger Bd 106, 1944, S. 850) für die Jahre 1930—38, also die für beide Untersuchungen gemeinsamen Jahre, betreffs der Frequenz pro 100,000 der dänischen Bevölkerung Zahlen ergeben hat, die in allen 9 Jahren durchschnittlich um 33 % tiefer liegen als die entsprechend in meiner Untersuchung für die schwedische Bevölkerung ermittelten, die aber andererseits auch während der 9 Jahre eine erheblich schnellere Zunahme der Prozentzahlen zeigen, als sie die Untersuchung für Schweden ergeben hat, so dass in den beiden letzten gemeinsamen Untersuchungsjahren 1937—38 die dänische Prozentzahl nur um 19 % kleiner ist als die schwedische.

Tabelle II

*Anzahl der operierten Fälle von Ulcus perforans*

Jahr	Bevölkerungs- menge	Pro 100,000 der Bevölkerung
1930	6,130,826	6 9
1931	6,152,009	7 8
1932	6,176,405	7 2
1933	6,200,965	7 2
1934	6,222,328	7 9
1935	6,241,289	8 4
1936	6,258,697	9 1
1937	6,275,805	8 2
1938	6,297,468	9 0
1939	6,325,759	9 2
1940	6,355,921	10 0
1941	6,388,953	9 8
1942	6,432,337	13 4
1943	6,490,514	11 3

Tabelle III.

*Der Jahresdurchschnitt an operierten Fällen von Ulcus perforans*

In der Zweijahres- periode	Absolute Anzahl	Pro 100,000 der Bevölkerung
1930—31	454	7 38
1932—33	146	7 20
1934—35	509	8 17
1936—37	543	8 66
1938—39	576	9 12
1940—41	630	9 88
1942—43	797	12 33

Wie aus diesen beiden Tabellen hervorgeht, hat die Anzahl der Fälle von operiertem Ulcus perforans pro 100,000 der schwedischen Bevölkerung während der letzten Zehnjahresperiode, seit 1933, wenn auch mit gewissen Schwankungen in den einzelnen Jahren, im grossen ganzen zugenommen, für jede Zweijahresperiode zeigt Tabelle III für diese 10 Jahre eine stetige Zunahme. In meinem vorigen Aufsatz wurde diskutiert, ob diese Zunahme (damals also bis zum Jahre 1940 einschl.) der operierten Perforationsfälle eine *wirklich* erhöhte Perforationsfrequenz in Schweden repräsentiere, oder ob diese Zunahme nur eine scheinbare sei, dadurch vorgetauscht, dass doch noch ein immer etwas wachsender Prozentsatz der Fälle in Krankenhausbehandlung und zur Operation gelangt wäre. Ich kam damals zu der Auffassung, dass man aus der Untersuchung mit grosser Wahrscheinlichkeit folgern

konnte, dass die Ulcusperforationen während der fraglichen Periode unter der schwedischen Bevölkerung tatsächlich prozentual zugenommen haben. Weit deutlicher noch dürfte dies aus der vorliegenden Untersuchung betreffs der beiden letzten Jahre hervorgehen. Berechnet man nach den Zahlen der Tabelle III die prozentuale Steigerung in der Frequenz operierter Perforationsfälle für jede Zweijahresperiode, ausgehend von der durchschnittlichen Jahresfrequenz der 4 Jahre 1930—33 7 29 Perforationsfälle pro 100,000 der Bevölkerung, so stellt man folgende Zunahme für jede der späteren Zweijahresperioden fest

für 1934—35	12 1 %
» 1936—37	6 0 %
» 1938—39	5 3 %
» 1940—41	7 2 %
» 1942—43	24 6 %

Somit eine standige, recht gleichmassige Steigerung in den Jahren 1936—41, dann aber eine sehr beträchtliche Zunahme in den beiden letzten Jahren, mit fast 25 % mehr Fällen in der Zweijahresperiode 1932—33 als in den vorangehenden 2 Jahren. In noch höherem Grad zeigt sich *die Steigerung besonders während des Jahres 1942* (856 Fälle) *mit etwa 35 % mehr pro 100,000 der Bevölkerung als in der vorangegangenen Zweijahresperiode 1940—41*.

*Das wesentliche Ergebnis dieser Untersuchung ist also, dass die Anzahl der operierten Fälle von Ulcus perforans in Schweden seit 1933 bis zum Jahre 1941 eine stetige, doch relativ langsame Steigerung um durchschnittlich 3—5 % pro Jahr zeigt, dass dann aber das Jahr 1942 plötzlich eine höchst beträchtliche Steigerung um nicht weniger als 35 % brachte und auch das Jahr 1943 eine erhebliche, wenn auch nicht ganz so hochgradige Steigerung aufwies (siehe Tab. II). Wir finden also während der beiden ersten Kriegsjahre, 1940—41, keine stärkere Frequenzzunahme als in den Vorjahren, während der beiden letzten verfloßenen Kriegs- und Krisenjahre, 1942—43, dagegen, besonders im Jahre 1942, eine auffallende und beträchtliche Frequenzsteigerung.*

Die nächste Frage lautet nun: Inwieweit kann man die Frequenz der Ulcusperforationen innerhalb einer Bevölkerung als einen Ausdruck und Messer für die Häufigkeit des Ulcusleidens in der betreffenden Bevölkerung ansehen? Oder anders ausgedrückt: Ist es sicher, dass die Anzahl sämtlicher Ulcusfälle in einem

Jahre wie z. B. dem Jahre 1942 in Schweden etwa in gleichen Verhältnis zugenommen hat wie die der Perforationsfälle? Dies ist eine recht schwierige Frage, die sich kaum mit Bestimmtheit beantworten lässt. Hier sind mehrere Faktoren zu beachten. Nach vielfachen Erfahrungen der letzten Jahre perforiert das Ulcus beim Manne relativ häufiger als bei der Frau, und das Ulcus duodeni relativ öfter als das Ulcus ventriculi. Eine Verschiebung der relativen Anzahl von Zwölffingerdarmgeschwüren und der relativen Anzahl von Männern in einem Ulcusmaterial wirkt also auf die Frequenz der Perforationsfälle in dem betreffenden Material ein. Wenn also die Duodenalgeschwüre und die Männer in dem Ulcusmaterial eines bestimmten Bezirkes in erster Linie zugenommen haben, wie es während der letzten 1—2 Jahrzehnte offenbar an den meisten Orten<sup>1</sup> der Fall gewesen ist, wenn auch in wechselndem Grade, so muss die Anzahl der Perforationen relativ starker anwachsen als die Anzahl sämtlicher Ulcusfälle in der betreffenden Bevölkerung. Auch etwas anderes ist zu

<sup>1</sup> Aus der einschlägigen Literatur nur einige beleuchtende Zahlen! Schon BAGER (Acta chir scand, Bd 64, 1929) fand in seinem grossen schwedischen Perforationsmaterial aus etwa 50 Krankenhäusern für die Jahre 1921—25 unter 693 Fällen 80 % Männer (in den Jahren 1911—1915 machten die Männer in seinem Material nur 63 % aus). Auch SEMBS norwegisches Material von 166 Perforationsfällen aus den Jahren 1912—29 (Acta chir scand, Bd 66, 1931, S. 315) zeigte eine ähnliche Verteilung nach den Geschlechtern 81 % Männer und 19 % Frauen. SCHILLINGS (Acta chir scand, Bd 76 1935, S. 249) Osloer Material von 194 Fällen aus den Jahren 1923—34 hat noch mehr Männer 88 % und nur 12 % Frauen, ebenso wie VARNER (a. O.) Material aus den Jahren 1919—38 mit 2,221 Fällen aus ganz Dänemark 90 % Männer und 10 % Frauen. In mehreren Kasustiken aus den letzten Jahren dominieren die Männer noch starker. So waren von HONKANENS (Nord medicin, Bd 10, 1941, S. 1307) 66 Perforationsfällen (Kuopio) 94 % Männer, von GRISVALDS (Ann of Surgery, Bd 113, 1941, S. 791) 111 Fällen (Louisville in Amerika) waren 96 % Männer, von ZIEGLERS (Mittel a. d. Grenzgeb. d. Med. u. Ch., Bd 46, 1942, S. 79) 166 Fällen (Wien) fast 93 % Männer, HERRMAN und MEYERS (D. Zschr. f. Chir., Bd 258, 1943, S. 495) 219 Fällen 91 % Männer, RAMBERGS (Skrifter av det norske Videnskabs Akademi 1943) 39 Fällen (Tonsberg) 95 % Männer und von ULLANDS (Acta chir scand, Bd 89, 1943, S. 195) 134 Fällen (Bergen) 91 % Männer.

Auch in bezug auf die Verteilung der Perforationsfälle auf Magen und Zwölffingerdarm ist in den letzten 20 Jahren eine merkliche Verschiebung festzustellen. In Zusammenstellungen aus diesen früheren Jahren dominieren die Magengeschwüre, so in BAGERS ebengenanntem schwedischen Material aus den Jahren 1911—25 mit 69 % in VARNER (a. O.) für ganz Dänemark aus den Jahren 1919—38 mit 79 % und in SCHILLINGS (a. O.) aus Oslo während der Jahre 1912—34 mit 66 %. Die Kasustiken der letzten Jahre zeigen ziemlich durchgängig eine bedeutende proportionale Zunahme der Zwölffingerdarmgeschwüre. In einzelnen Fällen ist diese stark ausgeprägt, wie in ZIEGLERS (a. O.) Zusammenstellung aus Wien vom Jahre 1932 und in ULLANDS (a. O.) aus Bergen für 1933, die beide etwa 80 % Zwölffingerdarmgeschwüre und nur 20 % Magengeschwüre verzeichnen. Aus ZIEGLERS Aufsatz sei ferner als für diese Frage aufschlussreich erwähnt, dass von allen versorgten Fällen von Ulcus ventriculi 74 % Perforationsfälle waren, von allen versorgten Fällen mit Ulcus duodeni 13,2 %. Ähnliche Angaben sind in der Literatur zahlreich mitgeteilt.

beachten! Bei im allgemeinen 50—60 % aller Perforationsfälle reicht — nach den Angaben vieler Kasuistiken<sup>1</sup> — die Ulcusanamnese über ein Jahr zurück, mit mehr oder weniger dauernden oder rezidivierenden Symptomen umfasst die Vorgeschichte in recht vielen dieser Fälle sogar mehrere Jahre. In den übrigen 40—50 % der Perforationsfälle ist die Anamnese kürzer als 1 Jahr, in recht vielen von diesen Fällen nur ein bis zwei Wochen oder, wie in 10—15 % aller Fälle, sogar nur wenige Tage, oder es tritt die Perforation fast ohne jede Vorboten als erste Manifestation des Ulcusleidens auf. Wenn nun die Perforationsfälle während eines Jahres in einem grosseren Material zunehmen — wie z. B. 1942 in ganz Schweden —, so kann dies natürlich grossenteils entweder darauf zurückzuführen sein, dass ältere Geschwüre häufiger als früher z. B. im Zusammenhang mit Rezidiven perforieren — soweit dies geschieht, nimmt die Anzahl der Perforationen relativ stärker zu als die Anzahl sämtlicher Ulcusfälle —, oder darauf, dass eine gesteigerte Anzahl neuer Geschwüre auftreten, von denen ein Teil bereits als frische Geschwüre oder nach nur wenigen Monaten perforieren<sup>2</sup> — soweit dies geschieht, entspricht der erhöhten Anzahl von Perforationen auch eine gesteigerte Anzahl von Ulcusfällen.

In Anbetracht der hier berührten Verhältnisse dürfte man allen Anlass haben, damit zu rechnen, dass die Anzahl der Perforationsfälle während einer bestimmten Zeitperiode in einer Bevölkerung *relativ* stärker zugenommen haben *kann* als die Anzahl sämtlicher Ulcusfälle. Indessen halte ich es doch für höchst wahrscheinlich oder so gut wie sicher, dass hinter einer so starken Steigerung — etwa 35 % — in der Frequenz der Ulcusperforatio-

<sup>1</sup> Als Beispiele seien aus der Literatur nur die Angaben einiger Kasuistiken angeführt. Von G. PLERLINS 89 Fällen (Lunds Universitets Årsskrift, 1911) hatten über die Hälfte jahrelang Ulcussymptome gehabt, in 12 % waren der Perforation so gut wie keine Symptome vorausgegangen. In BAGERS grossem schwedischem Material (a. a. O.) hatten von 1,188 Fällen 699 (= 59 %) seit 1 bis mehreren Jahren Symptome, 489 seit weniger als 1 Jahr, darunter 127 ohne nennenswerte vorherige Symptome. Bei 16 % von KRILLIS 152 Fällen (Surgery, Bd. 6, 1939) war die Perforation das erste Symptom der Krankheit. In ZIRGLERS Material aus Wien (a. a. O.) hatten unter 176 Fällen 48 % eine höchstens einjährige Anamnese, unter diesen hatten 12 % keine früheren Symptome gehabt.

<sup>2</sup> In der Literatur der letzten Jahre findet man vereinzelte Angaben, dass die Anzahl der Ulcusfälle ohne oder mit ganz kurzer Anamnese während der Kriegsjahre relativ im Perforationsmaterial stärker vertreten sei, wie bei A. SLANY (Häufung der Ulcusperforation seit Kriegsbeginn, Wien klin. Wschr. 1942, I, S. 171), oder auch im Gesamtulcusmaterial als tiefe Geschwüre, wie bei V. HOLLMANN (Das frische tiefe Magen- und Zwölffingerdarmgeschwür in seinem augenblicklichen Auftreten Arch. f. klin. Chir. Bd. 205, 1943, S. 163) in der chm. Klinik in Köln.

nen, wie sie 1942 bei der schwedischen Bevölkerung zu verzeichnen ist, auch eine erhebliche Steigerung der Frequenz sämtlicher Ulcusfälle steht *Diese Untersuchung gibt also m E eine gute Stütze für die von mehreren schwedischen Internisten geäußerte Ansicht, dass die Ulcuskrankheit in Schweden während der beiden letzten Kriegs- und Krisenjahre (1942 und 1943), und zwar besonders 1942, zugenommen habe*

Die Frage, wie man nun die Häufung der Ulcuskrankheit in Schweden während dieser Jahre erklären soll, sei schliesslich nur ganz kurz berührt, da sie sich bei unserer immer noch mangelhaften Einsicht in die Genese des Ulcus nicht mit Sicherheit beantworten lassen durfte. Die nachstliegende Erklärung durfte sein, dass die kriegsbedingten Veränderungen in der Ernährung weiter Kreise auch des schwedischen Volkes für Personen mit »Disposition« für Ulcus bzw mit schon bestehendem Ulcus die wesentliche Ursache für die Entstehung der Krankheit bzw für Rezidive gewesen sein werden. Im Hinblick auf die Tagesvariationen der Magenfunktion sind aber hier vielleicht auch die für viele durch die Zeitumstände verursachten Störungen in — um FORSGREN<sup>1</sup> zu zitieren — »einer einigermaßen rhythmusgemässen Lebensweise« mit auch regelmässigen Mahlzeiten zu beachten. Es ist auch möglich, dass die seelischen Belastungen, die gesteigerte Nervenspannung, die der Krieg mit seinen veränderten Lebensbedingungen für so viele mit sich gebracht hat, und die sich daraus ergebenden Einwirkungen auf das zentrale und vegetative Nervensystem ein wichtiger oder vielleicht ein noch wesentlicherer ursächlicher Faktor für die gesteigerte Ulcusfrequenz sind. Hierüber wissen wir nichts Bestimmtes.

### Zusammenfassung

Die Zusammenstellung aller in den Jahren 1930—1943 operierten Fälle von Ulcus perforans in Schweden zeigt, dass sich deren Anzahl langsam, um durchschnittlich 3—5 % jährlich, bis zum Jahre 1941 erhöht hat, dass dann das Jahr 1942 eine plotzliche Steigerung um 35 % brachte und dass die Anzahl operierter Perforationsfälle im Jahre 1943 um 25 % höher war als 1940—41. Die Untersuchung stützt somit die von mehreren schwedischen

<sup>1</sup> E FORSGREN, Die Tagesschwankungen der Magenfunktion aus diagnostischem, hygienischem und therapeutischem Gesichtswinkel Nord Medicin, Bd 24, 1944, S 1831

Internisten geausserte Ansicht, dass das Ulcusleiden unter der schwedischen Bevölkerung während des jetzigen Weltkrieges zugenommen hat, soweit es die Jahre 1942 und 1943 betrifft, namentlich das Jahr 1942

### Summary.

A survey of all the cases of perforating ulcer operated on in Sweden in the years 1930 through 1943 reveals that their number slowly increased by about three to five percent yearly up to and including the year 1941. In the year 1942 a sudden increase of 35 percent occurred, and in 1943 the figure was 25 percent higher than in 1940 and 1941. The investigation thus supports the opinion held by numerous Swedish physicians that the frequency of ulcer has increased in Sweden during the present World War, at least with regard to the years 1942 and 1943, particularly 1942.

### Résumé.

L'examen comparatif de la totalité des cas d'ulcères de l'estomac perforés opérés en Suède de 1940 à 1943 démontre que leur nombre a augmenté lentement, de 3 à 5 % annuellement jusqu'à la fin de 1941 pour accuser ensuite, dès 1942, une augmentation subite de 35 % et atteindre en 1943 en chiffre de 25 % plus élevé qu'en 1940—41. C'est dire que cet examen statistique corrobore l'opinion exprimée par plusieurs spécialistes de médecine interne que, durant la guerre mondiale actuelle, la fréquence de l'ulcère de l'estomac a augmenté parmi la population suédoise, du moins en ce qui concerne les années 1942 et 1943, mais surtout 1942.

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## On the Late Results in Non-operated Cases of Malleolar Fractures.<sup>1</sup>

### II

#### Fractures by Pronation

By

RAGNAR MAGNUSSON

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In cases of fractures by pronation the first injury is a fracture of the internal malleolus (In some cases there is only a rupture of the deltoid ligament) As secondary injury a transverse fracture of the fibula will be found, either distal or proximal to the tibiofibular joint, which is the reason why the bimalleolar fractures by pronation have by several authors (ASHHURST and BROMER, 1922, PALMER, 1941 and NIELS HANSEN, 1942 et al) been divided into two groups according to the localization of the fibula fracture It has been assumed that the firmness of the tibio-fibular ligament had a decisive influence on the type of fracture in each special case If the tibiofibular ligament resists the strain, a fracture would occur distal to the tibio-fibular joint (low fibula fracture), but if the tibio-fibular ligament ruptures, the fracture should be localized proximal to the tibio-fibular joint (high fibula fracture) These assumptions have, however, not been verified on my material

Both the unimalleolar and the bimalleolar fractures may be combined with a fracture of the posterior tibial margin

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<sup>1</sup> In a previous work the etiological grouping of the malleolar fractures, the diagnosis of injuries to the tibio fibular ligament and their frequency together with the late results of fractures by external rotation have been treated See R MAGNUSSON On the late results etc, Acta Chir Scand, Vol XC, Suppl LXXXIV, 1944

Table 1  
*All the fractures by pronation*

S e x	Unimalleolar		Unimalleolar with fracture of post tib margin		Bimalleolar		Bimalleolar with fracture of post tib margin		Fractures by luxation	
	No	P $\pm$ $\varepsilon$ (P)	No	P $\pm$ $\varepsilon$ (P)	No	P $\pm$ $\varepsilon$ (P)	No	P $\pm$ $\varepsilon$ (P)	No	P $\pm$ $\varepsilon$ (P)
Men	42 (17)	79.3 $\pm$ 5.6	4 (2)	40.0 $\pm$ 16.3	54 (25)	66.7 $\pm$ 5.2	15 (7)	48.4 $\pm$ 9.0	10 (8)	55.6 $\pm$ 12.0
Women	11 (10)	20.7 $\pm$ 5.6	6 (4)	60.0 $\pm$ 16.3	27 (9)	33.3 $\pm$ 5.2	16 (10)	51.6 $\pm$ 9.0	8 (6)	44.4 $\pm$ 12.0
Total	53 (27)	100	10 (6)	100	81 (34)	100	31 (17)	100	18 (14)	100

The figures in brackets denote the number of after examined cases

All the fractures with complete luxation of the ankle joint have, without regard to the number of fractures, been collected into one group

In a material of 791 cases of malleolar fractures 193 have been classified as fractures by pronation. Of these latter 98 cases have been after-examined clinically and roentgenologically. The distribution of the fractures by pronation on the different fracture groups and the distribution within these groups is seen from table 1, whence it also transpires that most cases are to be found within the group of bimalleolar fractures by pronation. This finding corresponds to earlier published statistical data (ASHHURST and BROMER et al) — The distribution over age and years is given in the column diagrams figs 1 and 2 — There were 59 men and 39 women among the 98 after-examined cases, which corresponds to  $60.2$  and  $39.8 \pm 4.9\%$  respectively, and 66 men and 29 women in the part of the material not after-examined, making  $69.5$  and  $30.5 \pm 4.8\%$  respectively. There is thus no statistically significant difference as to the distribution of sex.

55 fractures by pronation have occurred in traffic accidents, 89 through slipping, false steps etc. and 10 at sport or games.

The average age at the time of accident for all the fractures by pronation was  $39.4 \pm 1.3$  years. The men's mean age was  $34.4 \pm 1.5$  years and the women's  $47.4 \pm 1.3$  (table 2). The mean age of the women is thus higher than that of the men, and the dif-

Table 2

*Age at the time of accident of all the fractures by pronation*

	Number	$M \pm \epsilon (M)$	$\sigma$	$q_1$	Med	$q_3$
All the men	125	$34.4 \pm 1.5$	16.4	20.8	32.0	45.7
All the women	68	$47.6 \pm 2.4$	19.3	29.1	50.6	62.7
All the cases	193	$39.4 \pm 1.3$	18.5	23.2	37.3	54.1
After examined men	59	$34.7 \pm 2.0$	15.3	21.7	33.8	44.7
After-examined women	39	$43.5 \pm 2.9$	18.3	25.9	46.4	55.2
All the after examined cases	98	$38.2 \pm 1.7$	17.1	23.6	36.8	51.5
Non after examined men	66	$35.0 \pm 2.2$	18.1	20.3	30.0	48.1
Non-after-examined women	29	$53.9 \pm 3.7$	19.6	42.5	58.0	68.6
All the non after examined cases	95	$40.7 \pm 2.1$	20.4	22.8	38.1	57.3

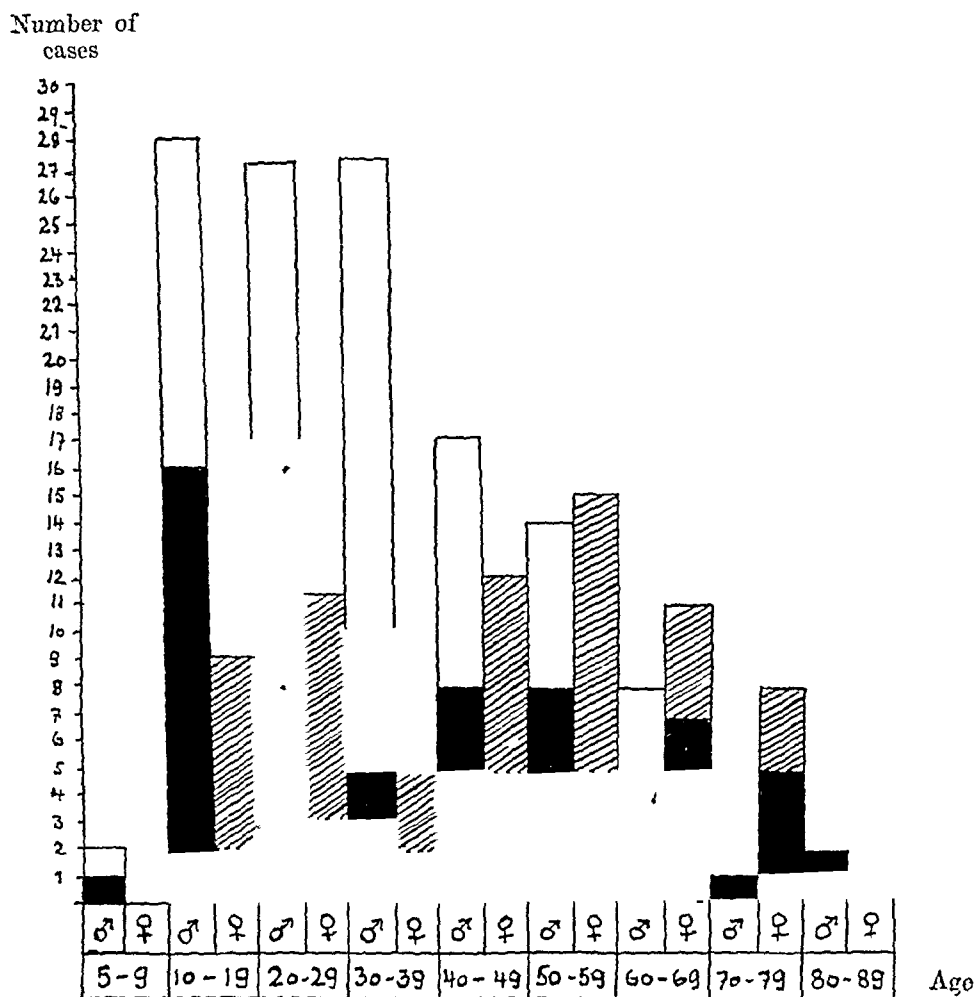


Fig 1 All the fractures by pronation (198 cases) Distribution within different age groups at the time of the accident (White areas = men, dotted = women Black parts of both areas = patients returned for examination)

ference is statistically well significant. An examination of the quartiles and the medians shows the women's values to be generally higher here, too. The same holds both for the after-examined and those not after-examined. — The mean age at the after-examination for the 98 cases was  $43.2 \pm 1.7$  years. As the mean age at the accident for the after-examined part of the material was 38.2 years, (table 2) the difference between the two last-mentioned figures is 5.0 years, which denotes the mean interval between the accident and the after-examination.

The mean treatment time, the mean time of immobilization and the time when the injured foot was burdened for the first time within the different groups of fractures are found in table 3.

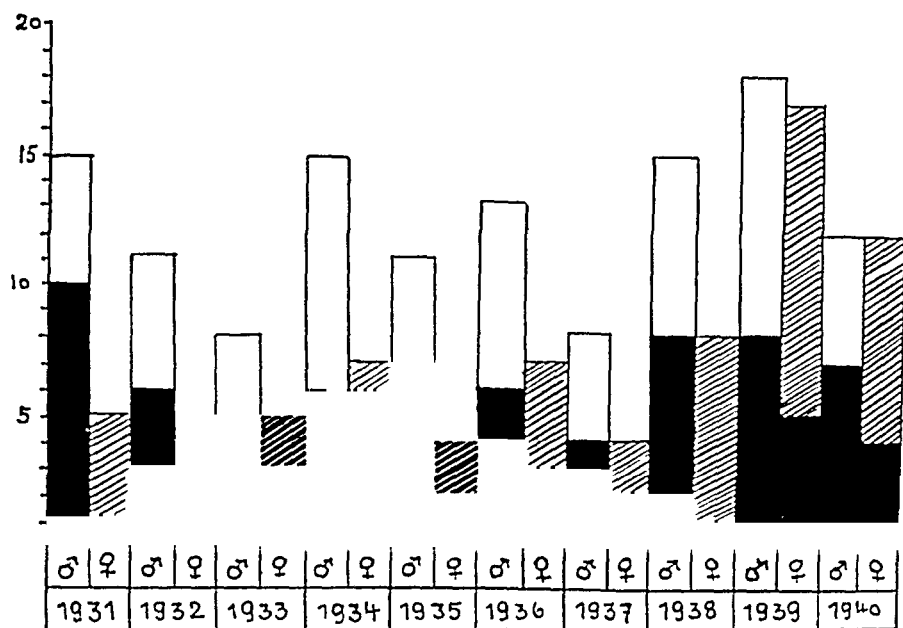
Number of  
cases

Fig 2 All the fractures by pronation (198 cases) Distribution in years at the time of the accident

Table 3

*Average treatment time, average time of immobilization and the time when the patients were first allowed to rest their weight on the foot after the accident (in days) for all fracture groups within the fractures by pronation*

Fracture group	Average treatment time $M \pm \sigma$	Average time of immobilization $M \pm \sigma$	Time of first rest on the foot (in days after the beginning of the treatment)
Unimalleolar fractures	$52.0 \pm 3.1^1$	$29.1 \pm 2.1$	$10.1 \pm 1.2$
Unimalleolar fractures with fracture of the post tib margin	$48.7 \pm 7.5$	$33.3 \pm 8.1$	$10.0 \pm 3.2$
Bimalleolar fractures	$67.8 \pm 3.6$	$32.1 \pm 1.9$	$9.1 \pm 1.1$
Bimalleolar fractures with fracture of the post tib margin	$84.6 \pm 8.4$	$40.1 \pm 3.7$	$10.7 \pm 5.3$
Fractures by luxation	$134.2 \pm 16.1$	$46.0 \pm 4.5$	$34.5 \pm 5.3$

<sup>1</sup> The average treatment time for the patients, treated only at the Out Patients Dep., was  $33.2 \pm 6.6$  days

The very short time of immobilization within some fracture groups should be noticed. Another curious fact is that, except in the group of fractures by luxation, the patients within all the other fracture groups have been permitted to put their weight on the foot at the same time after the accident.

### Clinical After-examination.

*Subjective troubles* have been found within all fracture groups (table 4). The symptoms were feelings of tiredness, pains on changes in the weather, pains and uncertainty when walking etc. — 37 patients in all (22 men and 15 women) of the 98 after-examined patients reported subjective troubles, which corresponds to  $37.8 \pm 4.9\%$ . The percentual distribution on men (59 after-examined) and women (39 after-examined) is  $37.3 \pm 7.9\%$  and  $38.5 \pm 7.8\%$  respectively. There is thus no statistically significant difference.

Among the 98 after-examined patients only one man — 30 years old at the time of the accident, and after-examined 3 years later — and one woman — 46 years old at the time of the accident, and after-examined 11 years later — declared that their troubles were so severe that they were unable to work full time. Both these cases belong to the group of bimalleolar fractures.

Table 4.

*Percentual distribution of the number of cases with subjective troubles, with valgus position and with arthrosis deformans [ $P \pm \epsilon(P)$ ] within all groups of fractures by pronation*

	Unimalleolar fractures (27) <sup>1</sup>	Unimalleolar fractures with fracture of the posterior tibial margin (6)	Bimalleolar fractures (34)	Bimalleolar fractures with fracture of the posterior tibial margin (17)	Fractures by luxation (14)
Subjective troubles	$18.5 \pm 7.6$	$33.3 \pm 21.1$	$41.2 \pm 8.1$	$52.9 \pm 12.5$	$50.0 \pm 13.9$
Unilateral valgus position	$3.7 \pm 3.7$	$16.7 \pm 16.7$	$11.8 \pm 5.5$	$17.6 \pm 9.5$	$21.1 \pm 11.1$
Unilateral arthrosis deformans	$33.3 \pm 9.2$	$50.0 \pm 22.4$	$58.8 \pm 8.4$	$70.6 \pm 11.1$	$78.6 \pm 11.4$

<sup>1</sup> Figures in brackets denote the number of after-examined cases within each group.

The man, who was insured against accidents, has an invalidity of  $33\frac{1}{3}\%$ . Another man, 31 years old at the time of the accident, and after-examined 9 years later, with a unimalleolar fracture, declared that he was only just able to manage on account of the pains in his foot. All the other cases with subjective troubles have retained their full working capacity. *The three above-mentioned cases were thus the only functionally unsatisfactory cases, making  $3.1 \pm 1.7\%$  of all the after-examined 98 cases.*

As to the distribution of the subjective symptoms over the different fracture groups (table 4), they are most frequent in the groups of bimalleolar fractures with or without fracture of the posterior tibial margin, and in the group of fractures by luxation, and least frequent in unimalleolar fractures. There is, however, no statistically significant difference between the highest and the lowest percentage figures ( $34.1 \pm 14.6\%$ ). On account of the relatively small number of cases the calculations are, however, uncertain and cannot warrant any safe conclusions. As was the case in the fractures by external rotation no objectively demonstrable changes could be observed as possible causes of the subjective symptoms.

*Mobility of the ankle joint.* In the bimalleolar fractures with and without fracture of the posterior tibial margin a statistically significant difference as regards *dorsal flexion* has been proved. When comparing the "normal values" <sup>1</sup> a difference of  $4.2 \pm 1.0$  is found in the bimalleolar fractures, and a difference of  $5.7 \pm 1.0$  in the bimalleolar fractures with fracture of the posterior tibial margin. The difference is thus, in both these cases, statistically significant. No statistically significant difference can be observed in the other fracture groups, which *might* be due to the small number of cases within some of the other fracture groups.

As to the *plantar flexion* no statistically significant differences between the normal values and the values of the injured foot could be observed.

*It is found here, as in the fractures by external rotation, that the limitation of movement affects the dorsal flexion while the plantar flexion is left unchanged.* It is difficult to pronounce with any certainty on the reason for this. It might, however, be due to the fact that most fractures are generally fixed with the foot in slight equinus position. The shortening of the Achilles tendon

<sup>1</sup> Dorsal flexion  $14.2 \pm 0.3$  and plantar flexion  $38.1 \pm 0.7$ . See R. MAGNUSSON On the late results etc., table 12, pag. 58.

which may easily take place with this method of treatment, may later cause a reduction of the dorsal flexion

Within all the groups a valgus position of the foot, localized only to the injured side, was found (table 4) in a total of 12 cases ( $12 \frac{2}{3} \pm 3 \frac{3}{4} \%$ )








### Roentgenological After-examination.

At the roentgenological after-examination the changes within the anterior tibial tubercle were especially studied. As mentioned in the introduction, injuries to the tibio-fibular joint were earlier on considered only to occur in fractures by pronation with a high fracture of the fibula. In my material *it was possible to observe certain signs of injury to the anterior tibio-fibular ligament within all the groups of fractures by pronation — that is to say, also among the unimalleolar and bimalleolar fractures with a low fibula fracture* (table 5) — An injury to the anterior tibio-fibular ligament was established in a total of 45 cases of the 98 after-examined (45.9 %). The distribution of the injuries to the tibio-fibular joint is, as can be seen from table 5, fairly even within the different fracture groups. Here, as in the fractures by external rotation, contour changes were more common than pseud-arthroses.

It may seem curious that injuries to the tibio-fibular joint, dating from the time of the accident, could not be ascertained in a greater number of cases of fractures by pronation. As the violence in this fracture is directed entirely laterally, a greater number of cases with injuries to the tibio-fibular joint might have been expected here than in the fractures by external rotation, for example. That such is not the case might be fully explained in the following way: in the fractures by pronation there has very often been a rupture of the ligament proper, i. e. an injury to the soft parts, which naturally has left no roentgenologically provable traces. This assumption is further supported by the fact that, of a total of 37 cases (not included the fractures by luxation) where a *certain* widening of the fork was found primarily, only 21 cases showed any changes of the anterior tibial tubercle at the time of the after-examination. It must be presumed that, although changes within the anterior tibial tubercle were only found in 46 % of the cases at the after-examination, the remaining 54 % must nevertheless have had an injury to the tibio-fibular joint at the time of the accident, as they in no way

Table 5

*Injury to the anterior tibial tubercle within the different groups of fractures by pronation*

Group	Sex	No	All the cases with injury to the ant tib tubercle		Among them			
					Pseud arthrosis		Contour changes	
			No	%	No	%	No	%
	♂	17	7	41.2	3	17.6	4	23.5
	♀	10	2	20.0	—	—	2	20.0
	Total	27	9	33.3	3	11.1	6	22.2
	♂	2	1	50.0	—	—	1	50.0
	♀	4	1	25.0	—	—	1	25.0
	Total	6	2	33.3	—	—	2	33.3
	♂	5	3	60.0	1	20.0	2	40.0
	♀	6	5	83.3	—	—	5	83.3
	Total	11	8	72.7	1	9.1	7	63.6
	♂	20	9	45.0	1	5.0	8	40.0
	♀	3	1	33.3	—	—	1	33.3
	Total	23	10	43.6	1	4.1	9	39.2
	♂	1	1	100.0	1	100.0	—	—
	♀	6	3	50.0	1	16.7	2	33.3
	Total	7	4	57.1	2	28.6	2	28.6
	♂	6	3	50.0	1	16.7	2	33.3
	♀	4	1	25.0	—	—	1	25.0
	Total	10	4	40.0	1	10.0	3	30.0
	♂	8	5	62.5	1	12.5	4	50.0
	♀	6	3	50.0	1	16.7	2	33.3
	Total	14	8	57.1	2	14.3	6	42.9
Total		98	45	45.9 ± 5.0	10	10.2 ± 3.1	35	35.7 ± 4.8

differ from the other fractures either as regards type of trauma or appearance of fracture

From the point of view of treatment it is significant that an injury to the tibio-fibular joint is generally attendant on uni-malleolar fractures by pronation (with or without fracture of the posterior tibial margin), and among the bimalleolar fractures, on those with low fibula fracture also

Fractures of the *lateral malleolus* have in all cases healed without any very great dislocation

In a total of 5 cases pseud-arthritis of the *internal malleolus* was found at the after-examination (one case within the uni-malleolar fractures with and without fracture of the posterior tibial margin respectively, and 3 cases among the bimalleolar fractures with fracture of the posterior tibial margin) In the remaining cases the fracture of the internal malleolus had generally healed without any very great dislocation

As regards *fractures of the posterior tibial margin* in cases with fracture of the internal malleolus only, this had healed without dislocation and without leaving any traces at the after-examination (only 6 cases were after-examined) — In the bimalleolar fractures with fracture of the posterior tibial margin (17 cases after-examined) a small unevenness within the posterior part of the joint surface of the tibia was found in 2 cases, in spite of the fact that, at the time of the accident, it had been impossible to see on the roentgenograms then taken that the injury had involved this surface In the remaining 15 cases a primary dislocation was found in 4 cases (in all cases large fragments with a sagittal breadth of 5—12 mm) In 2 of these cases the fragment had healed with a cranial dislocation of 1—2 mm No reposition had been performed in these cases — The posterior fragments in the fractures by luxation (14 cases after-examined) were, in all but 4 cases, large and with a sagittal breadth of up to 18 mm A cranial dislocation was found in 4 of these cases at the after-examination, whereas a dislocation of this kind had been found primarily in only 2 cases Thus, in 2 cases, a dislocation took place during treatment, most probably at the time when the patient began to rest on the foot

An *arthrosis deformans* localized only to the injured side was found within all the fracture groups (table 4) Such deforming changes were found in a total of 55 cases (35 men and 20 women), which corresponds to a percentual frequency of  $56.1 \pm 5.0$  The

percentual frequency of arthrosis deformans in men and women is  $59.3 \pm 6.4$  and  $51.3 \pm 8.0$  respectively. There is no statistically significant difference.

The frequency of arthrosis deformans within different fracture groups (table 4) is lowest in the unimalleolar group and highest in the group with fractures by luxation, and the difference is here statistically significant ( $45.3 \pm 14.6\%$ ).

I have earlier on been able to show that, in the majority of cases, the unilateral deforming arthrosis in fractures by external rotation was found in those cases where a lesion of the anterior tibial tubercle was found at the after-examination, and that this lesion might be considered a sign of persisting diastasis in the syndesmosis, at least in cases with pseud-arthritis. The logical consequence is, therefore, to investigate primarily the frequency of arthrosis deformans in the fractures by pronation, to see whether it is greater in the cases where a syndesmotic trauma was found at the after-examination than in the cases where no such trauma was found.

Some difficulties are, however, associated with an investigation of this kind. As mentioned above, the great majority of syndesmotic lesions in the fractures by pronation have very probably consisted in injuries to the ligament, i. e. purely injuries of the soft parts, which left no traces for the roentgenological after-examination. It is therefore not possible to obtain any even approximately correct basis for the calculation of cases with a presumably persisting diastasis in the malleolar fork. Consequently, it is also impossible to obtain a *certain* proof of the part played by the persisting diastasis in the development of an arthrosis deformans in the ankle joint in fractures by pronation. Arthrography might be of some diagnostic value here.

If the fractures by luxation are excluded (14 cases with 11 instances of arthrosis deformans), assuming as they do a place of their own due to the serious injuries to the soft parts, it is found that 23 of the remaining 44 cases with arthrosis deformans were found among the 37 cases, where *certain* roentgenological changes of the anterior tibial tubercle were observed at the after-examination, and the rest (21 cases with arthrosis deformans) among 47 cases without any such changes of the anterior tibial tubercle, which corresponds to a percentual distribution of  $52.3 \pm 7.7\%$  and  $44.7 \pm 7.3\%$  respectively. There is no statistically significant difference here, and it is therefore not possible to draw any con-

Table 6.

*Average age ( $M \pm \epsilon_M$ ) at the time of the accident and at the after-examination respectively of the cases without arthrosis deformans, with unilateral and with bilateral arthrosis deformans*

	Average age at the accident	Average age at the after-examination
Cases without deforming changes (31 cases)	$28.9 \pm 2.7$	$32.7 \pm 2.7$
Cases with unilateral deforming changes (55 cases)	$41.6 \pm 2.0$	$47.9 \pm 2.0$
Cases with bilateral deforming changes (12 cases)	$44.1 \pm 6.2$	$49.5 \pm 6.2$

clusions as to the importance of the changes of the anterior tubercle for the development of the deforming changes in the fractures by pronation

A certain syndesmotomic lesion was found *primarily* in the cases where there had been a larger widening of the fork together with a subluxation in the ankle joint. The cases of arthrosis deformans were distributed as follows over the cases with and without a primary widening of the fork. Among 37 cases with a *primary syndesmotomic lesion* 30 cases of unilateral arthrosis deformans were found, and among 47 cases without any *certainly* demonstrable primary widening of the fork 14 cases of arthrosis deformans were found (the fractures by luxation excluded), which corresponds to a percentual distribution of  $81.1 \pm 6.4\%$  and  $29.8 \pm 6.7\%$  respectively. The difference is  $51.3 \pm 9.2\%$ , and thus statistically well significant. These figures indicate that a greater number of deforming changes are to be expected in the cases with a primary widening of the fork together with a subluxation of the ankle joint than in the cases without any widening of the fork.

Two causes may be at work here. By the great widening of the fork and the ensuing subluxation of the ankle, greater or smaller injuries to the ligaments and the joint capsule develop, which may *per se* conduce to deforming changes in the ankle joint. As is evident from table 4 the fractures by luxation (with complete luxation of the ankle joint) have a greater frequency of arthrosis deformans than the other fracture groups. The same was true of the fractures by external rotation. This indicates, then, that the luxation and the ensuing injuries further the development of a

Table 7.

*Various degrees of severity of unilateral arthrosis deformans, distributed over all the fracture groups within the fractures by pronation*

Fracture group	(+)	+	++	+++	Total
Unimalleolar	8	1	—	—	9
Unimalleolar with fracture of the post tib margin	3	—	—	—	3
Bimalleolar	13	5	2	—	20
Bimalleolar with fracture of the post tib margin	5	3	1	3	12
Fractures by luxation	4	3	3	1	11
	33	12	6	4	55

deforming arthrosis Higher degrees of *subluxation* will also cause some injuries to the soft parts, of course, and they may presumably contribute to the increased frequency of arthrosis deformans in these cases. But it is also possible, on the other hand, that the reposition has not been satisfactory or that a secondary dislocation may have arisen during the course of treatment, so that a persisting diastasis has developed, which in its turn may have caused the deforming arthrosis by promoting smaller subluxations in the ankle joint.

Thus, the real cause of the deforming changes cannot be determined from the present material. Considering the results of my investigation of fractures by external rotation it seems most probable, however, that the primary subluxation with the ensuing injuries to the soft parts and the incongruity of the joint due to the persisting diastasis, work together in the development of the deforming changes in the ankle joint.

Regarding the fractures by external rotation I have been able to show that the higher ages play a certain rôle in the development of the unilateral deforming arthrosis. The same holds good of the fractures by pronation. As is seen from table 6 there is a statistically significant difference in the mean age for the cases without deforming changes and the cases with unilateral arthrosis deformans. There is, on the other hand, no statistically significant difference in the mean age between the cases with unilateral and with bilateral arthrosis deformans, as was the case with the fractures by external rotation. That such a difference is not found in the fractures by pronation might be due to the small number of cases with bilateral deforming changes. — The interval between

the accident and the after-examination of the cases without deforming changes, with unilateral changes, and with bilateral changes, does not show any very great differences

The distribution of the cases with unilateral deforming arthrosis over different degrees of severity is seen from table 7<sup>1</sup> The majority consists of slight deforming changes That well over 18 % of all the deforming arthroses belong to the most serious types shows, however, that some groups of fractures by pronation must be considered serious injuries

### Summary.

98 cases of fractures by pronation, collected during the 10-year period 1931—1940, have been after-examined clinically and roentgenologically The age and year distribution is seen from figs 1 and 2 The distribution of the material over different types of fractures is seen in table 1 The mean age at the accident is higher for the women than for the men (table 2) The mean time of treatment, time of immobilization (= time in plaster) and the time for the first use of the foot is seen in table 3

*Subjective troubles* (table 4) have occurred in a total of 37.8 % without any statistically significant difference between men and women Only in 3 cases were the subjective troubles so severe that the patients were unable to work (3.1 %) It has not been possible to find any objectively determinable causes for the subjective troubles

A statistically significant limitation of the dorsal flexion in the ankle joint was found in the bimalleolar fractures by pronation with and without fracture of the posterior tibial margin No limitation of the plantar flexion was found within any fracture group This *may* be due to the fractures' having been set in plaster in the equinus position, by which the Achilles tendon has been shortened, with an ensuing limitation of the dorsal flexion

Earlier on it was thought that fractures by pronation with low fracture of the fibula, i. e. fracture below the syndesmosis, were not accompanied by injuries to the syndesmosis *In my material, however, indications of an injury to the syndesmosis were observed within all the groups of fractures by pronation — thus, also among the unimalleolar and the bimalleolar fractures (with and without fracture of the posterior tibial margin) with low fracture of the fibula* (table 5)

<sup>1</sup> See R. MAGNUSSON On the late results etc., pag. 107, figs. 38—41

The small number of injuries to the syndesmosis, found at the after-examination of the fractures by pronation, may well be due to the fact that, *in most cases, ruptures of the syndesmotic ligament proper were in question*

Pseud-arthroses at *the internal malleolus* were found in 5 cases — The fracture of the posterior tibial margin had in 6 cases healed with cranial dislocation

An arthrosis deformans of the ankle joint, localized only to the injured side, was found in 55 cases (56.1 %), distributed fairly equally over men and women (cf table 4) — As many of the injuries to the syndesmosis consisted in injuries to the soft parts only, it has not been possible to assess with any certainty the part played by these injuries in the development of the unilateral deforming changes

The frequency of arthrosis deformans was found to be greater in the cases with a large *primary* widening of the fork than in the cases without any *certainly* demonstrable injuries to the syndesmosis at the after-examination. This may be due partly to the injuries to the soft parts occurring at the subluxation, and partly to an unsatisfactory reposition or to the fact that a secondary dislocation may have developed after too short a time of immobilization. It is most probable that these factors combine in the development of an arthrosis deformans — As in the fractures by external rotation, the cases with unilateral or bilateral deforming changes have a higher mean age than the cases without arthrosis deformans (table 6) — The varying degree of severity of the unilateral deforming arthrosis is seen from table 7

### Zusammenfassung.

98 Fälle von Pronationsfrakturen aus der Zeit von 1931—1940 sind klinisch und röntgenologisch nachuntersucht worden. Die Altersverteilung und die Verteilung des Materials auf die einzelnen Jahre ist aus den Abb. 1 und 2 zu ersehen. Die Verteilung des Materials bezüglich der verschiedenen Frakturtypen geht aus Tabelle 1 hervor. Das Alter der Frauen zur Zeit des Unfalls ist höher als das der Männer (Tabelle 2). Die mittlere Behandlungsdauer, die mittlere Immobilisationszeit (= Zeit in Gipsverband) sowie die Zeit, nach der der Fuss zuerst belastet wurde, geht aus Tabelle 3 hervor.

*Subjektive Beschwerden* (Tab. 4) kamen in zusammen 37.8 %

der Falle vor, dabei war kein statistisch gesicherter Unterschied zwischen Männern und Frauen vorhanden. Die subjektiven Beschwerden waren nur bei 3 Fällen so gross, dass die Patienten arbeitsunfähig wurden (3 1 %). Objektiv feststellbare Gründe der subjektiven Beschwerden waren nicht feststellbar.

Bei den Fällen mit bimalleolaren Pronationsfrakturen ohne und mit Fraktur des Margo post Tibiae ist eine statistisch gesicherte Herabsetzung der Dorsalflexion des Fusses festgestellt worden. Innerhalb einer der Frakturgruppen war die Plantarflexion etwas herabgesetzt. Dieses konnte darauf beruhen, dass die Frakturen in Spitzfussstellung eingegipst worden sind, wodurch eine Verkürzung der Achillessehne und infolgedessen eine Einschränkung der Dorsalflexion entstanden ist.

Es ist früher angenommen worden, dass Pronationsfrakturen mit einer niedrigsitzenden Fraktur der Fibula, d. h. mit einer Fraktur unter der Syndesmosis, ohne Syndesmosisverletzungen verlaufen. Innerhalb sämtlicher Gruppen von Pronationsfrakturen, also auch bei unimalleolaren und bimalleolaren (ohne und mit Fraktur des Margo post Tibiae) mit einer niedrigen Fraktur der Fibula (Tab 5) waren Anzeichen für Syndesmosisverletzungen vorhanden.

Die geringe Anzahl von Syndesmosisverletzungen bei Pronationsfrakturen, die bei der Nachuntersuchung konstatiert wurde, beruht wahrscheinlich darauf, dass es sich meistens um Rupturen der Syndesmosisbänder handelt.

Bei 5 Fällen bestand eine Pseudarthrose des *medialen Malleolus* — Bei 6 Fällen war die Fraktur des Margo post Tibiae mit einer kranialen Dislokation geheilt.

Eine ausschliesslich an der beschädigten Seite lokalisierte Arthrosis im Talo-cruralgelenk ist bei 55 Fällen (56 1 %), ungefähr bei ebensovielen Männern wie Frauen (vgl. Tab 4) nachweisbar. — Da ein grosser Teil der Syndesmosisverletzungen nur die Weichteile betroffen haben, ist es dem Verf. nicht möglich gewesen, sich eine sichere Auffassung der Bedeutung dieser Verletzungen für die Entstehung der unilateralen deformierenden Veränderungen zu bilden.

Bei der Nachuntersuchung ist bei Fällen mit einer grossen *primären* Gabelweitung eine grossere Deformationsfrequenz konstatiert worden als bei Fällen ohne direkt feststellbare Syndesmosisverletzungen. Dieses scheint verschiedene Ursachen zu haben, entweder eine mangelhafte Reposition oder eine sekundäre Disloka-

tion, die nach einer zu kurzen Immobilisationszeit entstanden sein kann. Wahrscheinlich arbeiten diese Faktoren bei der Entstehung einer Arthrosis deformans zusammen — Wie bei den Aussenrotationsfrakturen zeigen die Fälle mit einseitigen oder doppelseitigen deformierenden Veränderungen ein höheres Alter als die Fälle ohne Arthrosis deformans (Tab 6) — Die Schwere der einseitigen deformierenden Arthrosen geht aus der Tabelle 7 hervor

### Résumé.

98 cas de fractures par pronation, recueillis pendant la période de dix ans 1931—1940, ont été examinés cliniquement et radiologiquement en vue des résultats éloignés. La distribution du matériel dans le temps et sur les différentes années est mise en évidence par les fig 1 et 2. L'âge des femmes à l'accident est plus élevé que celui des hommes (diagr 2). La durée moyenne du traitement, de l'immobilisation (= temps passé dans le plâtre) et le moment où le pied a été employé pour la première fois est donné dans diagr 3.

Les troubles subjectifs ont été trouvés dans 37,8 % de tous les cas, sans différence statistique entre les deux sexes. Les troubles subjectifs n'étaient qu'en 3 cas si graves que les patients ne pouvaient pas travailler (3,2 %). Il n'était pas possible de constater de raisons objectives aux troubles subjectifs.

Dans les fractures bimalléolaires sans ou avec fracture marginale postérieure du tibia, notre statistique a démontré une diminution de la flexion dorsale du cou-de-pied. Dans un des groupes de fractures nous avons trouvé une petite diminution de la flexion plantaire. Cela peut tenir à ce que les fractures ont été plâtrées, le pied étant tendu, d'où il est résulté un raccourcissement du ligament d'Achille, et, par suite, une diminution de la flexion dorsale. On a précédemment supposé que les fractures de pronation avec une basse fracture du fibula, c'est-à-dire une fracture sous l'articulation syndesmodiale, ne seraient pas accompagnées de lésions des ligaments syndesmotiques. Des signes d'une telle lésion ont été observés dans tous les groupes de fractures par pronation, donc dans les fractures unimalléolaires et bimalléolaires (sans ou avec fracture marginale postérieure du tibia) avec une basse fracture du fibula (diagr 5).

Le petit nombre de lésions syndesmotiques, qui a été observé à l'examen tardif dans les fractures par pronation doit être dû au

fait que, dans la plupart des cas, les lésions n'ont concerné que les ligaments syndesmotiques

Des pseudarthroses du *malleole interne* ont été constatés dans 5 cas — Dans 6 cas la fracture marginale postérieure du tibia avait guéri avec une dislocation cranielle

Une arthrose déformante, localisée seulement du côté lésé du cou-de-pied, a été constatée dans 55 cas (56 1 %) avec à peu près la même fréquence chez les deux sexes (comp diagr 1) — Une grande partie des lésions syndesmotiques n'étant que des lésions des ligaments, il n'a pas été possible d'arriver à une opinion définitive de l'influence de ces lésions sur le développement des arthroses unilatérales déformantes

La fréquence d'arthrose déformante a été trouvée supérieure dans les cas avec un grand élargissement primaire de la mortaise tibio péronière que dans les cas où il n'était pas possible de trouver de lésions syndesmotiques véritables à l'examen tardif. Cela peut être dû ou aux lésions syndesmotiques, contractées au moment de subluxation, ou à une réposition non-satisfaisante, ou finalement, à une dislocation secondaire, développée après un temps trop court d'immobilisation. Le plus probable est que tous ces facteurs concourent au développement d'une arthrose déformante — Comme dans les fractures par rotation externe, les cas qui montrent des changements déformants unilatéraux ou bilatéraux sont d'un âge plus élevé que les cas sans arthrose déformante (diagr 6) — Le degré de gravité des arthroses unilatérales déformantes est mis en évidence par diagr 7

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# A Contribution to the Diagnosis and Therapy of Subcutaneous Urethral Lesions and Traumatic Urethral Strictures.

By

LARS TROELL

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## Introduction

Although the traumatic urethral ruptures are comparatively rare in peace-time, they, nevertheless, constitute an important group of injuries, not least with regard to the state of invalidity which may ensue. Much is demanded of the surgeon in treating the more severe forms which require the application of modern diagnostic and therapeutic means. If possible, the aim must be to avoid a traumatic urethral stricture. The chances in this respect are greatly dependent on the measures adopted at the first surgical treatment after the accident. However, when a stricture has formed, this sometimes calls for operative treatment which must be very radical in order to succeed.

Accordingly a survey of modern viewpoints on the diagnosis and therapy may be of interest. The present paper is based on a material from Karolinska Sjukhuset consisting of 11 cases from the years 1940—1943.

## Case Reports.

*Case 1* A N, 20 years of age. Case report no 1936/40. *Diagnosis* *Contusio penis cum ruptura urethrae et strictura*. Three years earlier, the patient had probably sustained a urethral rupture in connection with a slight blow on the penis without subsequent complications. Later, in a bicycle accident, he was struck in the crutch by the bicycle frame and obtained a partial urethral rupture in the pars pendula with hemor-

the right side. Hence it was decided to treat the patient operatively and now she was admitted to the hospital.

On  $10\frac{1}{2}$  42 (now the patient was a little over 17) *osteoplastic operation for sacralization* was performed after the method described above. The post-operative course was uncomplicated and the patient was discharged about two months after the operation, provided with a plaster corset which was removed one month later. On this occasion roentgenography showed a satisfactory position of the transplant.

About eight months after the operation the patient returned for control examination. Now she claimed to be perfectly free from symptoms and able to do any kind of work. Physical examination showed normal condition; in particular, the previous scoliosis had now disappeared.

Two years after the operation the patient returned again for control examination. She still claimed to be feeling perfectly well and to be fully able to work. Now and then, however, when stooping she had a little queer sensation over the loins but no real pain. No scoliosis could be made out on physical examination, and the mobility in the spinal column was normal. Roentgenography showed good healing of the bridge.

*Case 2. Female, 18 years old. (Reg. No. B. 10258).*

Past history of good health except for operation for appendicitis. On  $6\frac{1}{2}$  41 she applied to the clinic, complaining of pains in the back that had set in two years before, when she commenced working as a housemaid. The pains were localized to the lumbar region, especially the left; they were aggravated by work which required stooping. During the last three months she has been unable to work. Physical examination revealed no abnormal curvature of the vertebral column. On maximal stooping the patient complained of pain at the angle between the erector spinae and the iliac crest on the left side. No other abnormalities were made out. X-ray examination showed a pronounced sacralization of the left side, the transverse process of the 5' lumbar vertebra being transformed into the lateral mass extending over on the sacrum, with which it seemed to be in osseous contact. The patient was admitted to the hospital, and in order to test the yielding capacity of her back on strain, remedial gymnastics were prescribed. As these exercises aggravated her pain, operative treatment was decided on. On  $14\frac{1}{2}$  41 *osteoplastic operation for sacralization* was performed as described above. Apart from retention of the urine for the first couple of days after the operation, the course was uncomplicated, and the patient was discharged about two months after the operation, provided with a plaster corset that was removed one month later. About 10 months later, control examination. Now the patient was perfectly able to work, but now and then she had a little pain in the left lumbar region. She has not returned since for reexamination, but three years after the operation she informed us by mail that now she was completely free from pain and fully able to work, on which account she did not find it necessary to return for reexamination.

with hemorrhage, but neither retention nor perineal swelling. The patient did not, however, come under a doctor's treatment until 7 weeks later. He then had pronounced structural troubles with a small squirt and pollakisuria. Roentgen disclosed a considerable stricture in the pars bulbosa (Fig 6). After a couple of soundings, the stricture had a diameter of approximately  $1\frac{1}{2}$  mm (Fig 7). However, miction urethrogramms showed that the stricture did not constitute a hindrance to excretion (Fig 8). Nor did any clinical urination difficulties occur. At an after-examination 2 years later, he remained free from symptoms.

*Case 5* A F, 41 years of age. Case report no G1831/11. *Diagnosis* *Stricturea urethrae traumatica*. After a violent blow to the urethra 24 years ago, the patient sustained a transversal urethral rupture with bleeding from the urethra and, after a couple of hours, total retention. No perineal swelling. He was admitted to another hospital where repeated catheterization attempts were all unsuccessful. The rupture was sutured after having been prepared free from the perineum and the patient was detained with an indwelling catheter for two weeks. He was discharged with no urination troubles. However, fairly soon structural symptoms began to manifest themselves. Nevertheless, the patient did not apply to a doctor until 24 years later. A Roentgen examination then revealed a marked constriction one centimetre long (Fig 9). The trabeculation of the bladder wall indicated that the stricture constituted an insignificant hindrance to excretion. With the aid of guides, the stricture was successfully sounded to No. 18 Guyon, after which the patient was able to void without difficulty. When interrogated two years later, he stated that he had no urination troubles. Still, the roentgenological examination revealed a remaining stricture, forming an obvious hindrance to excretion. Thus, a pathological dilatation of the urethra behind the stricture was noticed simultaneously with the trabeculation of the bladder (Fig 10). The patient will be re-admitted at the earliest possible convenience for sounding if required.

*Case 6* T E, 27 years of age. Case report no G759/43. *Diagnosis* *Ruptura urethrae*. 12 hours prior to admission to Karolinska Sjukhuset, the patient was struck by a steel frame in the crutch and sustained a transversal complete urethral rupture. However, owing to but slight bleeding and the absence of swelling and urination troubles, the patient did not apply to a doctor until on the following day when acute retention had set in. An attempt at catheterization failed. The urethrogram showed a large rupture in the pars bulbosa with a cavity, the size of a walnut, below the urethral lumen (Fig 11 a and b). Immediate operation with perineal incision confirmed the clinical diagnosis. The rupture was sutured but, owing to the pronounced lesion of the tissue, this could not be done completely and a slight diastasis remained between the urethral ends. The patient was detained with an indwelling catheter for 4 weeks, the infection of the urinary tracts being avoided by means of simultaneous chemotherapy. A Roentgen examination, 4 weeks after the operation, disclosed a moderate stricture on the spot of the trauma.

A miction urethrogram did not reveal any hindrance to excretion (Fig 12) The patient had to be sounded every third week after his discharge

*Case 7* H L, 27 years of age Case report no G987/43 *Diagnosis Fractura pelvis + ruptura urethrae* In a collision between an aeroplane and a motorboat the patient sustained a pelvic fracture with considerable dislocation of the pelvic bones as well as urinary retention He was admitted to another hospital At an examination performed there, a hematoma was ascertained over the left renal region, as well as a splint injury in the perineum with the pars membranacea urethrae lying torn at the bottom of the wound A catheter readily passed the rupture into the bladder and clear urine was drained The rupture was sutured primarily and a catheter was retained for 2 days After this, the patient was able to void without difficulty He was administered chemotherapeutics and no infection of the urinary tracts ensued Three months after the accident, the patient was altogether free from symptoms and had a normal miction urethrogram (Fig 13)

*Case 8* J G-F, 17 years of age Case report no 1853/40 *Diagnosis Fractura pelvis + ruptura urethrae* In a traffic accident, the patient obtained a pelvic fracture, hemorrhages from the urethra and urinary retention No perineal swelling No signs of any injury to the bladder A catheter was retained for two weeks An infection occurred in spite of intensive treatment with urinary tract antiseptics After two weeks, urethrography showed that a stricture had developed on a level with the passage of the urethra through the diaphragma urogenitale without, however, constituting any hindrance to excretion (Fig 14) Seven weeks after the accident, the patient was sounded without difficulty to No 24 (A foreigner, not since heard of)

*Case 9* E H, 22 years of age Case report no Gc72/43 *Diagnosis Fractura pelvis + ruptura pars prostaticae urethrae* The patient was run over by a piece of heavy artillery, causing compression from side to side of the pelvis He was admitted to another hospital in a comparative state of shock Neither bleeding from the urethra nor swelling in the perineum However, he was unable to urinate A Roentgen examination revealed a pelvic fracture An attempt at catheterization failed Only blood was obtained in exchange A renewed Rontgen examination showed the catheter to be para-urethrally At operation, the pars prostatica urethrae was found to be completely torn away distally from the bladder neck A Pezzer catheter was introduced into the urethra via the bladder and fixed with slight tension causing the bladder neck to be pulled down towards the peripheral end A bladder fistula for two weeks The Pezzer catheter was retained for two months However, only two weeks after its removal, a stricture was ascertained with total hindrance to excretion Sounding was not particularly successful in improving the condition of the patient Accordingly, he was admitted to Karolinska Sjukhuset 6 months after the operation Roentgen then revealed, on a level with the spot of the rupture, an irregularly strictured part  $1\frac{1}{2}$  cm long with a fistula 1 cm long ending blindly

(Fig 15) The miction picture disclosed the considerable hindrance to excretion formed by the stricture which was further indicated by the trabeculation of the bladder wall (Fig 16) The urine was infected with cocci After attempts at sounding without any improvement internal urethrotomy was performed After this, the sounding was reassumed with better result The Roentgen examination now revealed a dilatation of the stricture after the operation (Fig 17) However, the hindrance to excretion remained with a pathological dilatation of the posterior urethra at miction (Fig 18) Three months after the discharge, the patient still had to be sounded every fortnight, on account of the tendency of the stricture to reappear Impotentia coeundi ever since the accident

*Case 10 B E*, 11 years of age Case report no 423/42 *Diagnosis Fractura pelvis + ruptura vesicae urinariae et urethrae* The patient obtained a pelvic fracture in a traffic accident with considerable dislocation of the bone ends in the left foramen obturatum, as well as a rupture of the bladder and the urethra He was admitted to Karolinska Sjukhuset in a pronounced state of shock The patient indicated pains in the pelvic region and in the lower part of the abdomen where also defense was noted with slight swelling and hematoma He was unable to urinate after the accident Nevertheless, there was no desire to void nor bleeding from the urethra, nor perineal swelling Catheterization was performed for the purpose of diagnosis No difficulty was encountered in passing into what was believed to be the bladder Blood and coagula being obtained in exchange, immediate operation was decided upon on a diagnosis of rupture of the bladder This diagnosis was confirmed by the surgical intervention Further, this rupture of the bladder was found to continue down the anterior wall of the urethra for 5—6 cm Thus, the introduced catheter had, via this rupture, come to lie para-urethrally and drained the blood-filled praevesical space which occurred at the rupturing of the bladder and the adjacent urethral part By introducing a bougie from the bladder through the proximal urethral opening and with a piece of silk tying it together with the withdrawn peripheral catheter, this was successfully brought through the undamaged urethral part up into the bladder Then, the ruptured bladder and neighbouring parts of the urethra were sutured On the other hand, the peripheral urethral rupture could not be sutured A bladder fistula and an indwelling catheter were applied, as well as praevesical drainage The course of healing was complicated by a urinary infection with attacks of pyelitis which were cured by the administration of sulfathiazole The bladder fistula was removed after a fortnight A urethro-cystogram four weeks after the operation revealed no stricture on the spot of the ruptures (Fig 19) The bladder was somewhat deformed as a result of the surgical intervention The catheter was removed after seven weeks At first, the patient was able to urinate spontaneously, but in attempts to drain the bladder, the catheter could not pass the peripheral rupture Roentgen disclosed an incipient stricture formation with indentations in the lumen (Fig 20) The lumen was also

strictured at the bladder neck. Still, the contrast substance could run into the bladder, though in but small quantities. A bladder fistula was again applied and several unsuccessful sounding attempts were made. However, the patient was able to urinate spontaneously at times. He was discharged 5 months after the accident in a satisfactory general condition with the bladder fistula in good function. After another two months, he returned for renewed operation. A Roentgen examination of the superior urinary tracts showed normal conditions and the urethrogram revealed a stricture approximately 2 cm. long in the pars bulbosa. No contrast substance could pass in attempts at injection from the urethra, nor from the bladder (Fig 21). Operation was performed seven and a half months after the trauma (Prof. HELLSTROM). *Urethral plastic with removal of the rounded cicatricial masses and suture of the urethral ends.* When the bladder had been opened, a silver sound could be inserted a couple of centimetres into the posterior urethra and the tip of the sound could be felt in the perineum at external palpation. A silver sound was also inserted from the external urethral opening and the distance between the tips of the two sounds was estimated to equal approximately three centimetres. The perineum was then prepared free with an arch-shaped incision, with the convexity facing anteriorly. The tissue under the subcutaneous adipose tissue was cicatricially transformed and strongly fixed to the adjacent pelvic parts. The rounded cicatricial masses continued up behind the symphysis, strongly fixing the urethra close to it. These adhesions were sharply cut away. Then, guided by the inserted sounds, the anterior and posterior urethral ends were dissected free and opened. Since the gap between them was found to be 4 cm., preventing direct union, further adhesions were detached between the corpora cavernosa and the symphysis. In this way, the anterior part of the urethra could be pulled down a couple of centimetres. However, also the posterior part of the urethra had to be mobilized either sharply or bluntly by detaching it all round, as well as the bladder neck and the distal part of the bladder. After this, the posterior urethra could be brought forward another couple of centimetres and the two urethral ends could be placed in contact with one another without tension. They were then sewn with fine metal sutures after the introduction of a catheter through the urethra into the bladder. The surrounding tissue was drawn together with catgut sutures, metal sutures being employed in the skin. Then a bladder fistula and an indwelling catheter were used. The after-course was uncomplicated. The bladder fistula was removed after 4 weeks, and the catheter 2 weeks later. Roentgen then showed, on the whole, normal conditions in the urethra (Fig 22). The patient was now able to void without difficulty, but the urethra revealed a tendency towards stricturing on the spot of the cicatrice. Accordingly, the patient was sounded every sixth week after his discharge from the hospital. Apart from urinary incontinency appearing on and off at exertion, the patient was quite free from symptoms. In a Roentgen picture taken five and a half months after the operation, only slight constriction and stiffness remained in the posterior urethra at the transition to the bladder (Fig 23).

*Case 11* E E, 44 years of age Case report no 605/42 *Diagnosis Fractura pelvis inveterata + strictura urethrae* This patient was crushed from side to side across the pelvis during work on a railway car At an examination at a hospital shortly after the accident, the patient was in a state of shock, unable to urinate and complained of pelvic pains Neither urethral hemorrhage nor perineal swelling Roentgen revealed a pelvic fracture After half an hour a urethral hemorrhage set in Moreover, a rounded tumour was palpable across the symphysis At the operation performed immediately after, this was found to be a large praevescical hematoma The bladder was uninjured but the urethra had ruptured a centimetre or two below the bladder On account of the bad general condition of the patient, suturing of the rupture was refrained from A catheter introduced through the urethra in a retrograde direction was drawn up into the bladder After the removal of the catheter after three weeks, the patient was at first able to urinate spontaneously, but after a few weeks a urethral stricture and an infection of the urinary tract developed The infection was repeatedly complicated by attacks of pyelitis and cystitis, as well as kidney and bladder calculi Two years and a half after the accident, during which time the patient had been utterly unfit for work, he was admitted to Karolinska Sjukhuset A Roentgen examination at the time revealed a stricture one centimetre long at the transition of the urethra into the diaphragma uro-genitale (Fig 24) The bladder was trabeculated and had a diverticle-like protrusion in the posterior wall The miction picture disclosed a pathological stiffness in the pars prostatica After pre-operative sulfathiazole treatment, operation was carried out (Prof HELLSTROM) *Urethral plastic with removal of cicatricial masses and suture of the urethral ends* according to the same method as in the preceding case No bladder fistula was applied The patient was detained with an indwelling catheter for four weeks At first, the patient was only able to void with a faint squirt, but when the urethra had been sounded a couple of times this improved The urethrogram two months after the operation, did not show any stricture (Fig 25) The trabeculation of the bladder remained but the diverticle formation had disappeared A fistula was observed from the operation area down into the perineum, but this was found to have healed at a renewed examination three weeks later At a control examination, a year and a half later, the patient stated that he had no troubles whatsoever in urinating In a few instances, he was sounded at the hospital of his home district Impotentia coeundi occurred as in case No 9

## Discussion

As regards the localization of the injury, urethral ruptures may be divided into two groups, viz, *extrapelvic ruptures* localized to the pars pendula and the pars bulbo-membranacea, and *intrapelvic ruptures* localized to the pars prostatica urethrae and the transition of the urethra in the diaphragma uro-genitale

In the present material, there are seven extra- and four intrapelvic lesions. One of the extrapelvic ruptures and all the intrapelvic ones are combined with pelvic fractures. In one of the cases, which has been included in the intrapelvic group, the lesion is localized to the transition between the intra- and extrapelvic part of the urethra, at the diaphragma uro-genitale.

### Pathogenesis and Pathology.

*Lesions of the pars pendula* are very infrequent and usually occur owing to a blow to the penis (case 1). *The lesions of the pars bulbo-membranacea* are due to a blow from below which strikes the perineum causing the urethra to be pressed against the symphysis and to be ruptured. Case 6 in the present material will serve as an illustration of this (fall astride a steel bar) as well as case 3 (kick in the perineum). In Anglo-Saxon literature (O'CONNOR 1936), particular attention has been paid to traumata due to the upward tilting of the cover plate of a manhole, the edge of which has struck the patient in the perineum, as the cause of a ruptured urethra (case 4).

*Lesions of the pars prostatica* occur in connection with pelvic fractures and, as a rule, happen in traffic accidents (cases 8 and 10), or owing to crushing injuries during the digging of wells, etc. (case 11). In these traumata, the branches of os pubis and os ischii are fractured and may at dislocation cut off the urethra. This happens when the impact hits the pelvis from the front backwards. At times, however, the pelvis is compressed from side to side causing its sagittal axis to become elongated and the urethra to be ruptured at the transition between the pars prostatica and the pars membranacea, while the ligamenta pubo-prostatica are torn simultaneously (cases 9, 10 and 11). The prostata and pars prostatica urethrae are pressed backwards owing to the increasing pressure from hemorrhages in the cave of Retzius and the continuity of the urethra is interrupted (PELKONEN 1943).

The urethral rupture may either be partial or total. At a total rupture, a retraction of the urethral ends follows owing to the elasticity of the urethra, resulting in the formation of a cavity filled with blood and coagula on the spot of the rupture. The urethral ends and the surrounding tissue are often torn and permeated with blood.

## Symptomatology.

The symptom picture in *extrapelvic urethral ruptures* is composed of the classic triad bleeding from the urethra, urination troubles often in the shape of urinary retention, and peri-urethral swelling with ecchymosis

1 *Bleeding* often occurs in close connection with the trauma and is also independent of the urination (cases 1, 2, 4, 5 and 6) It constitutes one of the most usual and sure signs of a urethral rupture Hematuria is absent in only two instances (cases 3 and 7) in the present material The bleeding is frequently more abundant at a partial rupture than at a total one In the latter event, the external hemorrhage is decreased owing to the violent retraction of the urethral ends all round (cp cases 1 and 6)

2 The *urination troubles* comprise all the various degrees, from a slight pain at urination to complete urinary retention In connection with the trauma, the patient feels a desire to void and slight or severe sensations of pain at urination In mild cases, the symptoms disappear after a few days (cases 1 and 2) Sometimes, during the course of a few weeks or more, a *stricture* is formed with an increasing difficulty to urinate and a gradually fainter squirt (case 4) At total ruptures, the troubles have now and then been restricted to an inability to empty the bladder altogether immediately after the trauma and, at urination attempts, bloody urine or coagula have appeared (cases 5 and 6) The ability to urinate does not invariably signify that the continuity of the urethra is undisturbed In the literature, cases have been described with a urination ability remaining 6 weeks after the total rupture (YOUNG)

3 *Peri-urethral swelling and possible ecchymoses* may, according to some authors, indicate the position of the rupture Thus, at ruptures in front of the diaphragma uro-genitale, the hemorrhage with concomitant swelling should spread downwards to the perineum and the scrotum, while, on the other hand, at intrapelvic ruptures, the hematoma should spread out in a prae- and paravesical direction Still, it must be assumed that when the violence is strong enough to fracture the pelvis or tear off an elastic urethra, it can simultaneously have damaged the fascias which divide the region in question into anatomically separate parts The blood has, in this way had a chance to spread in different directions Furthermore, the peri-urethral swelling is dependent on the time

Case 1

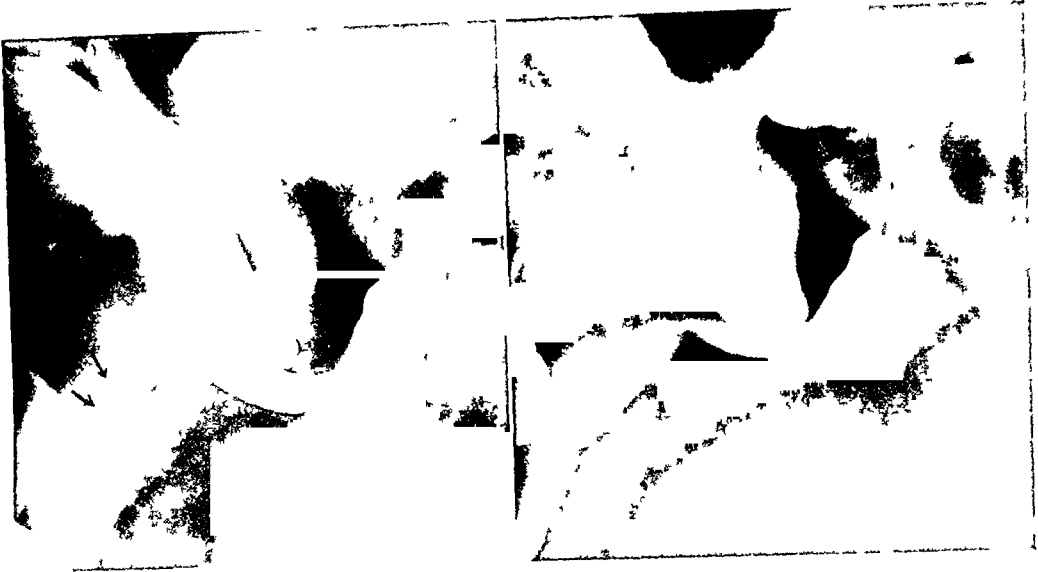


Fig 1.  
30/0 40

Fig 2  
17/0 41

Case 2

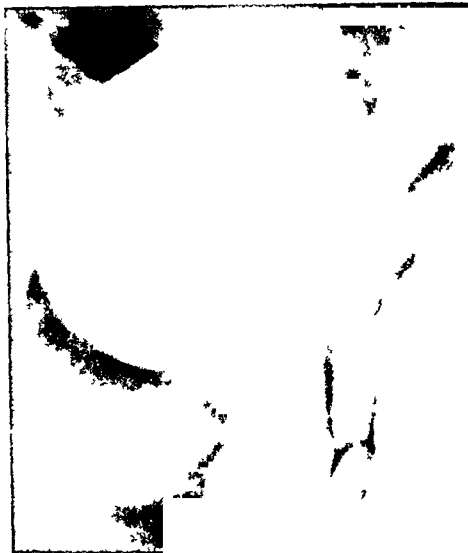


Fig 3  
1 1/2 44

C<sub>150</sub> 3



Fig 1  
17/8 38

Fig 5  
17/10 10

Case 4



Fig 6  
2/7 40

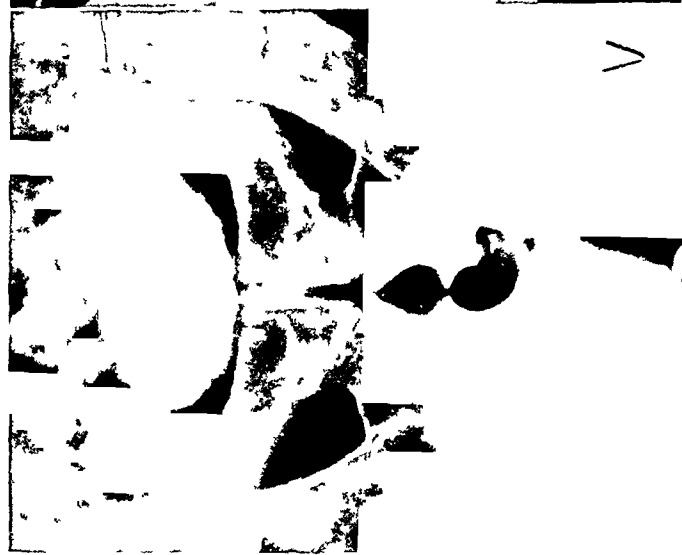


Fig 7  
7/9 40



Fig 8 (miction)  
21/11 40

Case 5



Fig 9  
31/6 41



Fig 10  
31/6 44

Case 7



Fig 13  
31/8 43

Case 8



Fig 14  
31/10 40

Case 6



Fig 11 a  
7/4 43



Fig 12 (miction)  
7/5 43

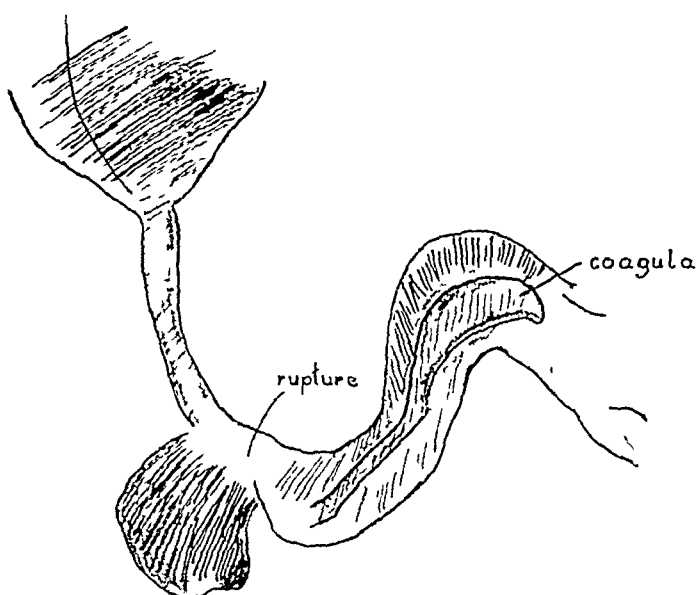


Fig 11b

Case 9



Fig 15  
14/7 43



Fig 16 (miction)  
14/7 43

Case 9



H

Fig 17  
2/8 43



H

Fig 18 (miction)  
2/8 43



Fig 19  
16/3 42



Fig 20  
7/4 42



Fig 21  
14/9 42



Fig 22  
7/11 42

V

Cise 10



Fig 23

11/3 43

Cise 11

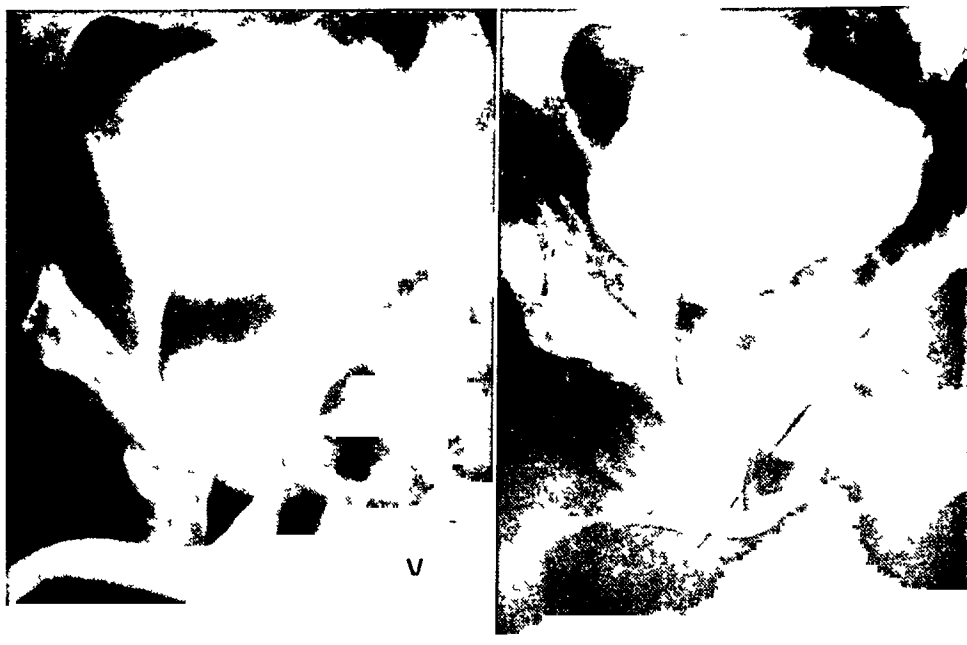


Fig 24

6/3 43

Fig 25

11/3 42

elapsing between the accident and the examination. A swelling in the perineum, not manifesting itself until after hours or even days, indicates a proximally situated trauma. In the present material, a swelling has not been ascertained in any single case (but all the cases were in fact admitted to hospital fairly soon after the trauma). In case 6, more than 12 hours have elapsed, but not even then was any swelling noticeable, merely an insignificant discoloration.

At *intrapelvic urethral injuries* combined with pelvic fractures, the symptoms from the urinary tracts are often overlooked. These patients are often in a state of shock (cases 10 and 11). Accordingly, it is hard to obtain any information regarding the desire to void, pains, etc. Sometimes the pains from the pelvic fracture completely dominate the picture, the symptoms of the urethral lesion developing later. In these instances, it is necessary to come to a decision regarding other possible injuries to the urinary tracts, as well as a kidney or bladder rupture, the localization of a possible urethral rupture in an extra- or intrapelvic position, with or without a bladder rupture. Often the patients with a pelvic fracture are unable to urinate owing to shock or pain without this necessarily indicating a lesion of the bladder or the urethra. When the shock or pain has abated by suitable treatment, the urination starts to function. Furthermore, the patient may have urinated just before the accident and, accordingly, had an empty bladder. The hemo-concentration appearing at the shock contributes in its turn to decreasing the urinary secretion (HARTWELL-HARRISON 1941). At total ruptures with *dislocation* of the prostata, it is stated that a soft filling is palpable per rectum, corresponding to a hematoma on the spot of the prostata (Fig 26). At palpation of the abdomen, a filling is sometimes noticed in its inferior part which gradually spreads out. In order, in such a case, to be able to perform a differential diagnosis between an intrapelvic urethral rupture with undamaged bladder and an extraperitoneal bladder rupture with defense, the limits of the rounded and filled vesica have to be ascertained by means of palpation (case 11). As a rule, the swelling at an extraperitoneal bladder rupture approaches one of the hypochondria (HAMILTON-BAILEY 1927). An incipient defense speaks in favour of a bladder rupture (case 10). Cases 9 and 11 show a typical symptom picture of a pars prostatica rupture. In case 9, no urethral hemorrhage was noted, but urinary retention occurred. At a later operation, the urinary bladder was

found to be intact with maintained cramp in the lisso-sphincter, which had hindered the urine from issuing into the pelvis. In case 11, a hemorrhage from the urethra was in fact observed half an hour after the accident. However, total urinary retention occurred and the filled urinary bladder was distinctly palpable through the abdominal wall. At operation the same picture was found as in case 9. In case 10, the symptom picture was obscured by the simultaneous occurrence of an extraperitoneal bladder rupture with defense and a swelling of the inferior part of the abdomen. Total retention occurred, but no bleeding from the urethra. In all these cases, the subjective troubles were dominated by the pain from the pelvic fractures. The urological troubles had not yet had

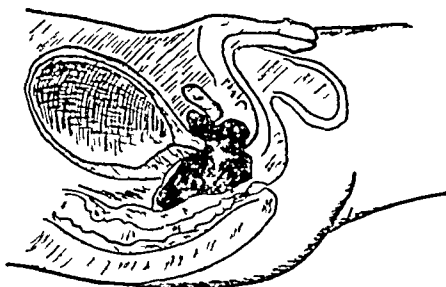


Fig 26

From the Brit J of Surgery 24, 1936/37, p 319

time to develop to their full extent. In both cases 9 and 11, impotentia coeundi developed. Information regarding similar troubles at extrapelvic lesions is lacking.

The appearance of urine phlegmon after a urethral rupture is, as a rule, dependent on neglected diagnosis and treatment. The urine penetrates from the damaged urethra out into the often maltreated tissue of the perineum and the scrotum. These parts rapidly become necrotic, are infected and become the seat of severe infections, often with gas gangrene. Death owing to sepsis is common. It usually takes a few days before such a picture has had time to develop. At intrapelvic lesions the reflectory cramp in the sphincter vesicae may protect against urinary leakage, at least for a few hours.

### Diagnosis.

Guided by the above-mentioned symptoms, it is, as a rule, possible to decide whether or not a urethral rupture occurs. In

order to obtain a more exact knowledge of the localization and nature of the injury, i. e. whether it is partial or total, and whether other parts of the urinary tracts have also been damaged (the latter particularly when a pelvic fracture is suspected), further examinations are required.

Of old, catheterization has been the method by means of which the surgeon has tried to gain a clearer idea of the ruptured urethra, in spite of the complete awareness of the drawbacks connected with this examination method. Apart from the risk of infection, even careful catheterization may easily cause additional hemorrhages and a partial urethral rupture may be transformed into a total one. In French and Anglo-Saxon literature, in particular (MARION, LEGUEU, HARTWELL-HARRISON, SCHIELE-WAGNER, and SIMPSON-SMITH), the application of a catheter is strongly deprecated. A case which may serve as an example of this attitude may be mentioned, concerning an English seaman who suffered from total retention after a urethral lesion. He was regularly subjected to a puncture of the bladder for a couple of days while waiting for hospital treatment at the next port (MARION 1914).

In the present material, *the extrapelvic urethral lesions without urinary retention* and with comparatively mild, rapidly transient troubles have not been catheterized with a view to diagnosis (cases 1 and 2). As regards case 4, the patient neglected to follow the doctor's orders and a stricture had had time to develop after three weeks. This serves to emphasize the importance of a careful examination of every suspicious urethral lesion. In all the cases *with urinary retention* (cases 3, 5, 6 and 7), catheterization was performed. The catheter could be introduced without difficulty into the bladder only in case no. 7. At the operation later on, the rupture could be seen extending over the inferior wall of the urethra while the catheter had followed the superior wall. In all the remaining cases (cases 3, 5 and 6), catheterization failed and the urethra was further injured with concomitant hemorrhages in connection with the catheterization attempts. As far as cases 5 and 6 are concerned, distinct clinical signs of a urethral rupture occurred with total interruption of the continuity (urinary retention with palpable bladder and bleeding from the urethra). The question is whether catheterization should not have been avoided in these cases.

In the *intrapelvic urethral ruptures* the clinical picture in cases 9 and 10 was such as to suggest immediate surgical intervention.

In both cases, attempts at catheterization had failed, the tip of the catheter being retrieved para-urethrally at the operation. In these cases a risk indisputably exists of the penetration of the catheter into an extravescical accumulation of urine. When faintly bloody urine is drained by the catheter, an erroneous conclusion may easily be drawn. Consequently, a rupture of the bladder or the urethra may, perhaps, not be subjected to the immediate operative treatment which is required. Such instances have been described in the literature (YOUNG). Thus, at catheterization, the position of the tip of the catheter, in or outside the vesica, should, in doubtful instances, be controlled through injection of contrast. Catheterization in case 10 did not encounter any difficulty in entering into what was believed to be the ruptured bladder. At operation, a rupture of the bladder was, in fact, found but, in addition, a rupture of the urethra was diagnosed through which the catheter had passed, causing the tip of the catheter to lie para-urethrally. In case 11, catheterization was not performed, operation instead being carried out in accordance with the clinical picture.

A urethroscope and a cystoscope are even more unsuitable as diagnostic aids than the catheter, owing to their lack of suppleness.

Urethrography is a method of examination which fulfills the highest demands with regard to exactitude as well as gentleness. However, it is not altogether reliable. Even when carried out *lege artis*, with careful sterility, a certain *risk of infection* remains. Further, owing to the hypertonicity of the solution, also *chemical irritation* of the mucous membrane of the urethra is sometimes involved which usually subsides after a day or two. Finally, in the case of a possible reflux, *emboli* may appear when an oil emulsion is used as contrast substance. The unsatisfactory experiences from urethrography of a fresh urethral lesion which are mentioned in foreign literature may, no doubt, owe their explanation to the use of oil emulsions (PELKONEN 1943). At Karolinska Sjukhuset, a sterile contrast matter soluble in water is nowadays employed in urethrography, viz, iodide anol. However, only in one of our cases (case 6) has urethrography been employed in connection with the first examinations. No complications set in. It appears that urethrography should be resorted to primarily more frequently than hitherto, before any other procedures, when symptoms of urethral injuries such as hemorrhages and urination troubles occur.

When suspecting a pelvic fracture and an intrapelvic urethral rupture, in addition to skeleton Roentgen also useful assistance may be derived from intravenous urography. Thus, it is possible to obtain simultaneously a conception of the occurrence of lesions of the kidneys and the bladder, as well as intrapelvic urethral ones. In cases of a rupture of the bladder, the contrast matter runs out into the pelvis minor, whereas in a rupture of the urethra the bladder will in some instances be distinctly visible owing to cramp of the sphincter vesicae. In certain cases, blood coagula may be observed lying in the bladder, a valuable finding speaking in favour of the occurrence of a lesion of the bladder or the bladder neck. When only skeleton Roentgen is used, sometimes the shadow of an uninjured vesica filled with urine may be seen in the pelvis.

As regards *urethral lesions which have lead to a stricture*, a valuable diagnostic aid is to be found in the contrast examination. A conception is obtained of the nature and localization of the stricture whether it is solitary or multiple (cases 1, 2, 3 and 4) and whether it is circular or longitudinal (cases 4, 5 and 10). When a hindrance to excretion occurs, the bladder is subjected to hypertrophy in order to overcome the obstacle. Roentgen discloses this in the shape of trabeculation (cases 5, 9 and 11) or the formation of diverticles (case 11). A certain idea of the degree of hindrance to excretion is obtained in miction pictures. In cases of strictures with a hindrance to excretion, the posterior urethra or the bladder neck is seen to be more dilated than normally (cases 5 and 9, Figs 10 and 18).

### Therapy.

As regards the treatment of urethral lesions, the therapy at the time of the accident must be differentiated from that used in connection with the later troubles.

The two *extrapelvic lesions without urinary retention* (cases 1 and 2) were administered conservative treatment. Case 1 with an indwelling catheter and chemotherapy, and case 2 with chemotherapy only. Both cases healed without later troubles. However, at an after-examination, the urethro-cystogram revealed a stricture on the spot of the trauma. This is in conformity with PELKONEN's (1943) experience of strictures developed even in mild cases.

The *extrapelvic lesions with urinary retention* have been of a kind necessitating *external urethrotomy and urethral suture* after

repeatedly unsuccessful attempts at catheterization (cases 5, 6 and 7) Cases 5 and 6 have healed with a stricture which was later sounded Case 7 is the only one which has healed without a stricture In this instance, an indwelling catheter was kept for only two days In the other cases, the catheter was retained for 1—4 weeks (cases 1, 5 and 6) In spite of the absence of an infection of the urinary tract, a stricture had developed in cases 1, 2, 3, 4 and 6 The bacterial growth normally occurring in the urethra probably plays a certain part with regard to the appearance of an inflammation which constitutes one of the causes of traumatic strictures An indwelling catheter should be applied in order to maintain the caliber of the urethra and hinder the damaged tissue from healing with shrunken scars

Three of the *intrapelvic ruptures* (cases 9, 10 and 11) have been operated on with suprapubic cystotomy and an indwelling catheter for 3—8 weeks A bladder fistula has been applied in 2 cases (cases 9 and 10) All three cases have healed with an infection in the urine and strictures with concomitant considerable difficulties to evacuate In case 9, a Pezzer catheter was introduced, by means of which the neck of the bladder was pulled down towards the peripheral urethral stump In case 10, the bladder and the superior urethral rupture were sutured, but the inferior part was left untouched as in the case No 11 Case 8 was treated with an indwelling catheter for two weeks, the stricture troubles setting in after seven weeks

In these cases with a bladder fistula and a retained catheter, good help is derived from a so-called *continuous tube* from the abdominal incision through the whole urethra and out to the orifice, or else a piece of silk tied to the urethral catheter can be directed via the abdominal incision, thus facilitating later changes of catheter

In the latter treatment of the *strictures*, sounding was at first attempted after having taken a Roentgen picture of the lesion Owing to this, all the cases, except Nos 9, 10 and 11, were to a large extent successful in temporarily reducing the patients' troubles After sounding for some time in case 9, with only a very temporary improvement, internal urethrotomy was performed When this had healed, sounding was reassumed with comparatively good result In case 10, a stricture 2 cm long was ascertained with rounded cicatricial masses on the spot of the trauma In case 11 a chronic urinary tract infection had developed, com-

plications being added in the shape of cysto-pyelitis, bladder and kidney calculi, and a stricture 1 cm long on the spot of the rupture with an adjacent abscess cavity. In both these cases, resection of the cicatricial masses and urethral suture was performed after suprapubic cystotomy and external urethrotomy. It is of the very greatest importance that all cicatricial tissue, which is often indurated and strongly fixed to the surrounding bone parts, is carefully removed (sharp dissection). In order to get rid of the diastasis of frequently 3—4 cm between the urethral ends occurring in this connection, the urethra must be mobilized forwards and backwards, in the course of which also the bladder neck and the inferior part of the bladder may have to be cut free. Suturing of the urethral ends is most suitably performed with thinly applied fine metal stitches which, however, may only involve the periurethral tissue. In order to obtain a filling of the cavity which is formed round the urethra when all the cicatricial tissue has been removed it is sometimes necessary to draw a flap of skin fat down from both sides towards the spot of the resection. An indwelling catheter was used in both cases (cases 10 and 11) for 3—5 weeks, entailing an infection. In case 11 the patient was troubled for some time by a perineal fistula. A bladder fistula was applied in case 10 for 4 weeks, though not in case 11. Approximately one month after the operation, the patient was first sounded. The functional result was very good in both cases, still the patient in case 10 was troubled somewhat by a bladder incontinency which he has been suffering from ever since the time of the accident.

### Summary.

The material of urethral lesions from Karolinska Sjukhuset (11 cases) is subjected to an analysis with regard to the symptomatology, diagnosis and therapy. The mechanism of origin of the different types of urethral lesions is discussed. In diagnosing a fresh urethral lesion, immediate catheterization is advised against. Instead urethrography is recommended as a means of obtaining as exact an idea as possible of the injury. The drawbacks connected with urethrography are as follows: a risk of infection and chemical irritation of the mucous membrane. The risk of emboli appearing at a possible reflux is neutralized when a contrast substance soluble in water, viz., iodide airoil, is used instead of the oil emulsions employed earlier. As regards the late results, a

stricture occurred in all the cases but one. No difference was noticeable between the infected cases and the uninfected ones. The cases which healed with pronounced strictures of the urethra and with ringed cicatricial masses in the perineum have been successfully operated on with suprapubic cystotomy and external urethrotomy with the careful removal of the cicatricial masses and suture of the urethral ends.

### Zusammenfassung.

Das Material des Karolinska Sjukhuset an Urethriaverletzungen (11 Fälle) wird in bezug auf Symptomatologie, Diagnose und Therapie einer Analyse unterworfen. Der Entstehungsmechanismus der verschiedenen Typen von Urethraverletzungen wird besprochen.

Bei der Diagnose einer frischen Urethraverletzung wird von einer unmittelbaren Katheterisierung abgeraten. Stattdessen wird Urethrographie empfohlen als Mittel zur Erzielung eines möglichst exakten Bildes von der Verletzung. Die mit der Urethrographie verbundenen Nachteile sind folgende: Gefahr einer Infektion und chemischen Reizung der Schleimhaut. Die mögliche Gefahr einer Embolie mit dem rückstromenden Blute wird behoben, wenn statt der früher gebräuchlichen Ölemulsionen ein in Wasser lösliches Kontrastmittel, z. B. Airoljodid, zur Verwendung kommt. Was die Spätresultate anbelangt, so trat in sämtlichen Fällen, ausser einem, Striktur auf. Zwischen den infizierten und den uninfizierten Fällen war kein Unterschied bemerkbar. Die mit ausgesprochenen Strikturen der Urethra und reichlicher Narbenmasse im Perineum geheilten Fälle wurden mittels suprapubischer Zystotomie und äusserer Urethrotomie sowie sorgfältigen Abtragens der narbigen Massen und Vernahung der Urethraenden erfolgreich operiert.

### Résumé

L'auteur a soumis le matériel (11 cas) de lésions urétrales de Karolinska Sjukhuset à une analyse du point de vue symptomatologique, diagnostique et thérapeutique. Il discute le mécanisme de l'origine des lésions de différents types. L'auteur est d'avis qu'il faut éviter le cathétérisme dans le cas de lésions fraîches. Il recommande par contre l'urétrographie comme un moyen permettant d'obtenir une image aussi exacte que possible de la le-

sion Les inconvénients pouvant résulter de l'urétrographie sont le risque d'infection et d'irritation chimique de la muqueuse On pare au risque d'embolie résultant d'un reflux possible par l'usage d'une substance opaque soluble dans l'eau, tel l'iodairol, au lieu des émulsions huileuses utilisées autrefois Dans tous les cas sauf un, il se produisit une stricture comme résultat éloigné Il n'y eut à cet égard pas de différences notables entre les cas infectés et ceux qui ne l'étaient pas Les cas qui guérissent avec des strictures accusées et la formation de masses cicatricielles couenneuses dans le périnée furent opérées avec succès par cystotomie sous-pubienne et urétrotomie externe avec excision soignée des tissus cicatriciels et suture des portions de l'urètre

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## Volvulus Caeci.

By

ARNT JAKOBSEN

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### I. Introduction.

In the surgical departments of Ullevaal Hospital we have in the past year noted a remarkable increase in the number of cases of cæcal volvulus. Whereas cæcal volvulus was formerly a rare occurrence in this country, it has now come to be a condition that we must reckon with in the diagnosis of ileus. This fact, viewed in connection with the development of X-ray diagnosis in recent years, makes it justifiable to give a survey of the matter, illustrated by personally observed cases.

From clinical quarters quite a large amount of literature has been published on the subject, while only some few roentgenological reports have hitherto appeared (LAURELL, HOLUBEC and others). Most of the clinical accounts come from Finland, Russia and the Baltic countries. From the rest of Europe and from America only some occasional reports are to be found. From this fact we can hardly draw any other inference than that cæcal volvulus is especially associated with these regions. The explanation thereof will be discussed hereafter.

The first detailed description of cæcal volvulus was given in 1899 by v ZOEGE-MANTEUFFEL, who was then professor at the University of Dorpath in Esthonia. FALTIN's extensive works on the subject were published in Finland in 1902 and EKEHORN's work in 1903. Apart from the results of X-ray diagnoses there has been little to add to the searching and exhaustive investigations of these authors. It is noteworthy that the next rather comprehensive publication from Finland on cæcal volvulus (OHMANN)

did not appear until 1924. In the same year HARALD JACOBSEN collected 20 Danish cases of cæcal volvulus observed in the course of 25 years.

From Sweden and Norway a number of individual cases have been reported (ROMAN, SMIT, INGEBRIGTSEN, AARS-NICOLAYSEN, BREKKE, WILL and SERCK-HANSEN).

## II. Definition and Pathogenesis.

By cæcal volvulus we understand a condition in which there has taken place a torsion of the cæcum on the axis of the mesenterium and where parts of the ascending colon, sometimes also of the transverse colon, as well as larger or smaller portions of the lower loops of the ileum, are subjected to torsion (WILMS, KLEINSCHMIDT and HOHLBAUM). Some few authors also include cases where the state of ileus has been produced by a bending off of the cæcum in the transverse axis of the intestine. (FALTIN, EKEHORN). The present writer accepts the former definition.

The following pathologico-anatomical and mechanical factors come into consideration as regards the occurrence of cæcal volvulus: Volvulus of the cæcum does not arise where the intestine and the mesenteries are of normal construction. A necessary requirement for the occurrence of cæcal volvulus is that the cæcum and, as a rule, the ascending colon shall be mobile, i. e. that they have a comparatively broad mesentery. There is then generally present a mesenterium ileocolicum commune. Some authors (KLEINSCHMIDT and HOHLBAUM) regard this as an indispensable condition, while others (FALTIN) mention as rarely observed causes of a movable cæcum an abnormal elasticity of the retro-cæcal connective tissue and a specially marked extension of the free part of the cæcum. In our cases a mesenterium ileocolicum commune was always present.

*Mesenterium ileocolicum commune* is due to an anomaly in development arising during torsions of the intestinal canal in fetal life. It is no rare occurrence. Post mortem statistics show a frequency of from 10 per cent (WANDEL) up to 23 per cent (DREIKE). As cæcal volvulus is a rare disorder as compared with mesenterium ileocolicum commune, it is obvious that other causes must contribute to the occurrence of volvulus cæci. In the introduction it was mentioned that Finland, Russia and the Baltic countries show most cases of cæcal volvulus.

The proportion between the total number of intestinal occlusions and caecal volvulus in Finland has been found to be 14 per cent of 152 occlusions (FALTIN) and 16 per cent of 318 occlusions (OHMANN). For comparison it may be mentioned that in the same statistics sigmoid volvulus is found to constitute respectively 21 per cent and 16 per cent.

Some investigators have sought for the explanation of the great frequency of caecum volvulus in these regions in racial peculiarities manifesting themselves by the more frequent occurrence of mesenterium ileocolicum commune. Post mortem statistics from Finland (TISSALA and WALLENUS) show, however, a frequency of mesenterium ileocolicum commune amounting to 10 per cent, or about the same as has been found in Switzerland and Germany, where caecal volvulus is comparatively rare. The theory which seems most plausible and which FALTIN strongly favours is to the effect that the kind of nourishment, especially the composition of the food, is the direct predisposing element in the production of caecal volvulus, namely the almost exclusive consumption of vegetables by the Russian peasant and the Finnish peasant's diet of potatoes and sour bread. OHMANN mentions dry food, soft black bread, as predisposing cause and points out that a great increase of caecal volvulus in the Viborg district arose in 1918, simultaneously with scarcity of corn and an abundant addition of substitutes to the flour used for making bread. Similar observations were made during the famine in Russia in 1920—21 (WACHSNER).

During the rationing of food now in force in NORWAY there is being eaten coarser and darker bread than was formerly usual, and also large quantities of kohlrabi and potatoes, altogether foodstuffs which leave much residue and produce much gas. It is reasonable to suppose that this large production of gas in the bowels during a longer or shorter time every day will lead to varying degrees of intestinal atonia. Taking this in connection with a reduction of the fat content in the mesenteries which is a natural consequence of the general emaciation which has been noted during the existing restriction of food supplies, the author believes that we can find herein the direct cause of the increased frequency of caecal volvulus in recent years.

As initiatory causes of the torsion of the bowel in cases of caecal volvulus have been mentioned an abrupt movement, a sudden backward jerk of the upper part of the body, or a fit

of vomiting (v ZOLGE-MANTEUFFEL) A physiological state of torsion amounting to 180 degrees is often to be found in persons with mesenterium ileocolicum commune This may reasonably be supposed to lead to a condensation of the contents of the bowel and a partially hindered emptying thereof, as well as to formation of adhesions When a sudden abrupt movement then takes place it may easily be imagined that the torsion will be complete The mechanism of the procedure may be described as follows

The inertia moment of the intestine increases proportionally with the reduction in elasticity occasioned by the constant distention The greater the moment of inertia is, the greater will be the danger of manifest volvulus on sudden movements The torsion may proceed in right or left direction, and the degree of torsion will depend on the existing anatomical conditions The difference in types of cæcal volvulus that occur is of minor importance for the surgeon, who will be able to find guidance through direct vision during the laparotomy operation For the roentgenologist, on the contrary, the distinguishing of different types will be of considerable importance for the interpretation of the X-ray findings

The age of the patients is in most cases found to be between 17 and 30 years (FALTIN), in contrast to sigmoid volvulus, where only 12 per cent are under 30 years old (EDGREN) The author's patients were aged respectively 10, 13, 20, 30 and 80 years This supports the assumption that in case of cæcal volvulus the congenital element (mesenterium ileocolicum commune) is most in evidence, while in sigmoid volvulus it is acquired factors (mesosigmoiditis) and other changes due to age that are decisive (WILMS) For cæcal volvulus the ratio between men and women is equal, while for sigmoid volvulus the ratio is 5 : 1 (EDGREN)

Pregnancy is by some authors (FALTIN) supposed to hinder the occurrence of cæcal volvulus, whereas others (SMIT, ROMAN) think that it is, on the contrary, a predisposing factor ROMAN has collected 8 cases and SMIT has described a case of combined cæcal and sigmoid volvulus occurring during the puerperium

### III Own Cases

No 1 Woman aged 82 9237/36 Admitted  $\frac{8}{6}$  36 Died  $\frac{11}{6}$  36

Had previously never suffered particularly from costiveness or attacks of abdominal pains For a fortnight before admission she had subileus symptoms, in the last 24 hours total occlusion of the bowel

Present state Looks ill, tongue furred, complains of severe abdominal pains Abdomen Everywhere greatly distended No tenderness or palpable fulness No audible intestinal sounds

Urine albumen + Rest-N in blood 100 mg per cent

Otherwise nothing pathological in the general condition

X-ray examination, in supine position, shows a colon distended to the size of a man's head and a couple of less distended loops of the small intestine (Fig 1) In supine position with horizontal radiation there is seen a greatly distended colon with a fluid level at least 20 cm long (Fig 2)

The X-ray examination ought to have been supplemented by a barium enema and would then probably have revealed an unmistakable caecal volvulus, but at that time (1936) the technique for roentgenological diagnosis of ileus had not yet been fully elaborated at the hospital and the X-ray diagnosis arrived at was ileus The pre-operative diagnosis was colon ileus Tumour? There was then performed in local anesthesia Laparotomia Resectio caeci The distended portion of the intestine was found to be the caecum, which on the basis of the ascending colon was twisted 720 degrees At the point of transition between caecum and ascending colon the bowel was thin and atrophied, probably as an indication that a latent state of torsion had existed for some time Besides there was seen a string-shaped fold of the peritoneum from the site of the torsion to the posterior abdominal wall Detorsion was carried out and the distended caecum was resected outside the abdominal cavity The patient stood the operation well, but diffuse peritonitis developed, with fatal result

No 2 Boy aged 8 years Admitted  $12/1$  1943 Discharged  $26/1$  1943

Had previously always been well No constipation Two days before admission he got attacks of abdominal pains On the next day he felt quite well Twelve hours before admission he had pains again One attack of vomiting No stools or passage of wind in the last two days

Present state Not looking very ill Free from fever

Abdomen No marked meteorism, but some tenderness in right fossa iliaca No palpable congestion

Increasing tenderness, wherefore operation on the diagnosis of appendicitis

Ether narcosis Laparotomia Detorsio et fixatio caeci Appendectomy There was found a torsion of the caecum, ascending colon and a small part of the transverse colon, with a mesentrium ileocolicum commune extending to the middle of the colon transversum After detorsion the tænia of the caecum were fixed to the McBurney  $\lambda$ -incision

The postoperative course was complicated by an ileus which necessitated a fresh laparotomy and loosening of a newly-formed adhesion

X-ray examination was not made

Control-examination after 9 months In good health

No 3 Woman aged 20 13665/42 Admitted  $13/8$  42 Died  $24/8$  42

Has for a year been troubled with constant abdominal pains, nausea and vomiting Never any stoppage of the intestinal passage X-ray

examination of stomach gave negative findings Four hours before admission to hospital she awoke with severe pains in stomach, which afterwards persisted Last motion of bowels took place before the pains began Little passage of wind after that time She has vomited several times

Present state Looks very ill Complains of violent abdominal pains She is free from fever and her tongue is moist Apart from the abdomen there is nothing to remark about the general condition

Abdomen Everywhere greatly distended, hard as a board, with marked defensive rigidity No information as to intestinal sounds

X-ray examination — survey of abdomen and barium enema "Shows a colon greatly distended by air, (Fig 3) with fluid level both in transversum and caecum (Fig 4) Barium enema shows free passage up to a point a hand's breadth beyond the flexura lienalis (Fig 5) Here the contour of the mucous membrane suggests a state of torsion Diagnosis volvulus of colon probable"

Six hours after beginning of the attack there was performed in spinal anesthesia Laparotomia, Detorquatio Hemicolectomia et ileostomia There was a large quantity of ill-smelling sanguinolent fecal fluid in the abdominal cavity There was found a volvulus which embraced the caecum, the ascending colon and the right half of the colon transversum, with a torsion of 540 degrees The twisted portion was necrotic and was resected after detorsion and removal of the contents of the bowel through a Nelaton catheter inserted into the appendix Both stumps were closed by forceps and drawn forward into the incision, and were not opened until the day after the operation After a temporary improvement she died of peritonitis ten days after the operation

No 4 Boy, aged 13 Admitted <sup>20</sup>/<sub>10</sub> 1942 Discharged <sup>31</sup>/<sub>10</sub> 1942

Respectively one year and half a year before admission he had had attacks of non-characteristic abdominal pains of one day's duration The pains came on in spasms and were accompanied by vomiting He does not remember further details The last 24 hours before admission he had constantly had at intervals of 5 minutes severe griping pains in the epigastrium, combined with vomiting Great rumbling in stomach and no stools or passing of wind after the pains set in

Present state Does not seem very ill Temp 38 Tongue moist Abdomen Meteorism especially localized to the epigastrium During examination there came a visible peristalsis of the intestine, extending from the epigastrium over towards the left side Numerous resonant sounds over the site of the local meteorism in the epigastrium A good deal of tenderness over McBurney's point

Otherwise nothing to remark as to the general condition

X-ray examination revealed the typical picture of caecal volvulus The general survey pictures showed a large distended colon loop, (Fig 6) which in standing position presented two fluid levels (Fig 7) Single fluid levels in the small intestine The barium enema stops at a point corresponding to the right flexure, but without any distinct torsion contour (Fig 8)

The diagnosis, however, was unfortunately not made either by a clinician or by a roentgenologist, and the diagnosis for the operation was ileus, presumably due to acute appendicitis

Over twenty-four hours after the beginning of the attack there was performed in ether narcosis Laparotomy Detorsion of caecum Appendectomy and caecostomy There was found a greatly distended caecum, with a torsion of 360 degrees at a point immediately distal to the hepatic flexure Mesenterium ileocolicum commune was found to exist The bowel was not injured and after detorsion it was emptied of air and contents by means of an intestinal tube introduced from the rectum The appendix was removed, as its apex was medially attached to the pole of the caecum and it acted as a constricting cord Finally a section of the pole of the caecum was drawn forward through a Mc Burney incision and fixed there

The functioning of the intestines was soon resumed after the operation and it was not found necessary to open the exposed bowel Barium enema one month after the operation showed a long-looped ascending colon, but the caecum lay in its usual place (Fig 9) On control examination after nine months the patient was in good health

No 5 Man, aged 30 Admitted 20/1 1943 Discharged 1/5 1943

Has never before had stomach troubles Ten hours before admission to hospital he awoke with abdominal pains, localized to the right fossa iliaca He vomited and has had no passage of stools or flatus since the pains set in

Present state Looks somewhat ill Afebrile

Abdomen Slight meteorism around the umbilicus Distinct tenderness to pressure over McBurney's point Urine showed slight albuminuria and red blood corpuscles on microscopical examination

X-ray examination Urography shows nothing noteworthy The roentgenograms, however, revealed a large distended colon loop, (Fig 10) which ought to have given occasion for taking photographs in standing position and for use of barium enema

On the diagnosis of acute appendicitis there was performed in spinal anesthesia 14 hours after beginning of attack Laparotomy, Detorsion and fixation of caecum There was found a typical caecal volvulus with 360 degrees torsion, as well as a pronounced mesenterium ileocolicum commune, extending to a point immediately distal to the flexura hepatica After detorsion the air was forced over to the distal parts of the colon and from there led out through a rectal tube After detorsion it is seen from distinct marks of pressure, which did not lead to necrosis, that the bowel must have been twisted 180 degrees for a long time A caecal tænia was fixed both in the Mc Burney-incision and in the upper part of the diarectal incision by a number of interrupted silk sutures

The course of the case was free from complications Barium enema one month after the operation showed a long-looped ascending colon and a caecum in its proper place

#### IV. Clinical Observations.

Patients who get manifest ileus due to cæcal volvulus will often be found to have previously presented slight signs of a similar condition. In the anamnesis we frequently find mention of constipation and of attacks of colic with vomiting — often regarded as cases of appendicitis. Among 79 cases of cæcal volvulus such premonitory symptoms were noted by FALTIN in 30 patients. The present author's case No. 4 had two such attacks beforehand.

The acute symptoms usually vary somewhat, with a combination of obturation and strangulation symptoms according to the degree of circulatory disturbance that occurs. The attack generally comes on suddenly, at first with coliclike, afterwards with continuous abdominal pains. The author's first two cases are of the severe strangulation type with correspondingly violent symptoms. The others, in which the symptoms are milder, are also found to have a typical obturation ileus without any great disturbances of circulation.

Vomiting occurs as a rule, while cessation of flatus and stools is not a quite constant phenomenon.

The abdomen quickly becomes distended and Wahl's sign — a local meteorism — is most often met with in the upper part of the abdomen, frequently in the left hypochondrium. In the author's case No. 4 Wahl's sign was present in the epigastrium and in case No. 5 in the umbilical region.

The right fossa iliaca is usually empty, but not always (v. MANTEUFFEL).

Occasionally there is tenderness over the meteoristic part, as in the author's Case 4, otherwise the abdomen is not tender to touch.

Resonant intestinal sounds are heard over the meteoristic area in the author's Case 4.

It must, however, be remembered that in case of fresh severe strangulation there is no distention of the afferent loop of the bowel, which on the contrary remains contracted for a long time (WAHL, v. MANTEUFFEL). In these cases there will not be found either on clinical or on roentgenological examination any pronounced meteorism orally to the point of strangulation, and likewise little or no visible peristalsis. Exploration yields no positive data.



Fig 1.



Fig 2

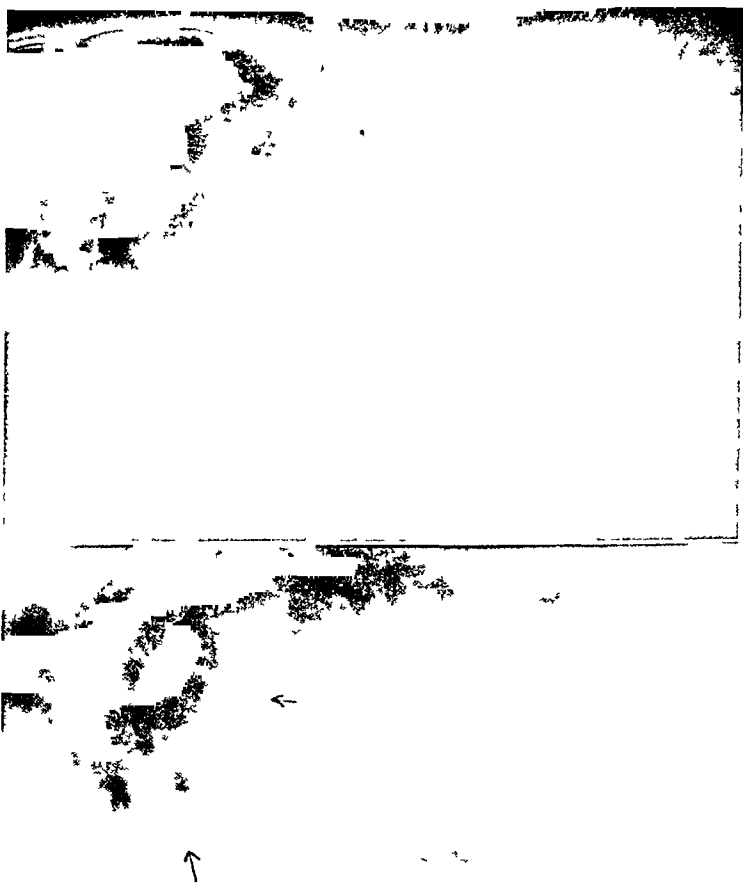


Fig 3

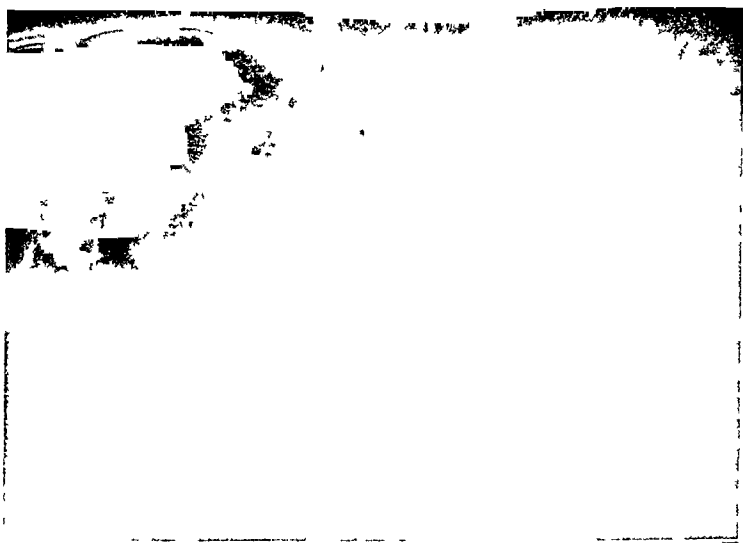


Fig 4

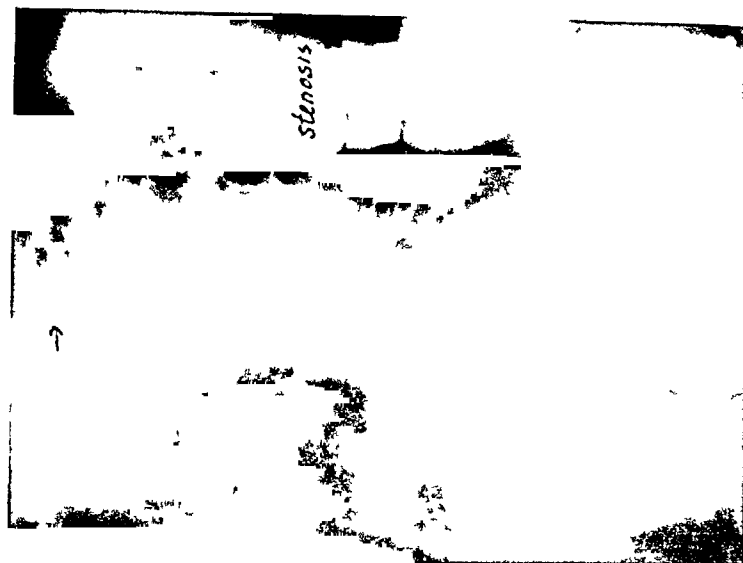


Fig 5

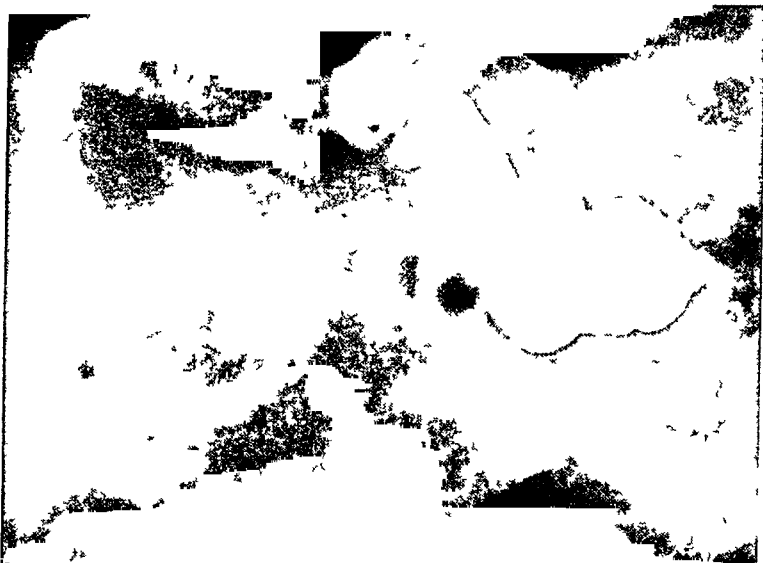


Fig 8



Fig 7



Fig 6



Fig 9

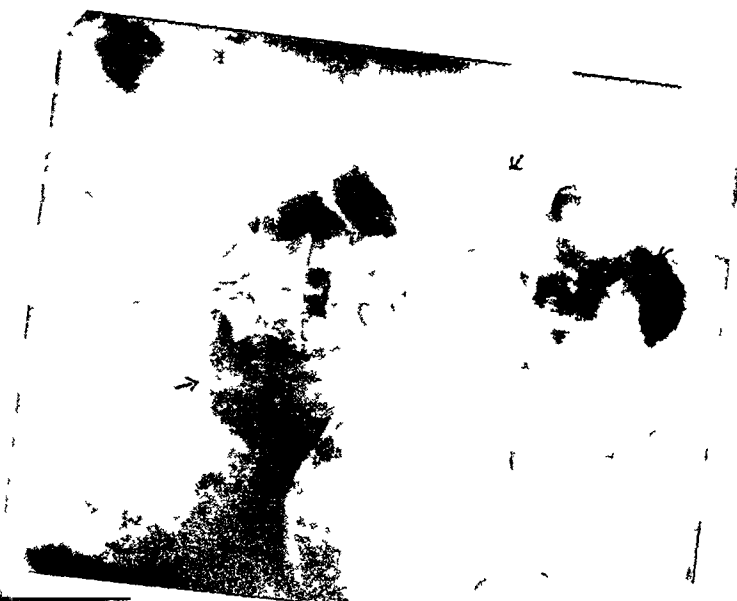


Fig 10

As regards the differential diagnosis sigmoid volvulus comes first into consideration, and nextley ileus of the small intestine. Formerly the two types of colon affection were distinguished from each other by examining how much enema fluid the bowel could take up, it being assumed that a patient with sigmoid volvulus could not take in more than from one half to three quarters of a litre and usually less than this. The X-ray examination has made this enema test superfluous.

The author's cases have been investigated at the roentgenological section of Ullevaal Hospital (Chief FRIMANN-DAHL, M. D.). The technique is the same as for other acute abdominal affections. First there is taken a general survey of the abdomen in supine position. Afterwards the abdomen is taken in standing position with translumination. If the patient is too ill to stand, he is photographed by horizontal radiation while lying on his side. As a rule the examination is supplemented by barium enema, with translumination.

The typical roentgenogram in caecal volvulus shows a greatly distended caecum of varying size, with one, more rarely two, large fluid levels when the patient is in standing position or lying on his side (the author's Case 4). In case of sigmoid volvulus two large fluid levels are almost always seen. In cases of caecum volvulus there is also found a fluid level in the small intestine as in ordinary ileus of that bowel. The barium enema stops at the point of torsion and there is generally seen a typical torsion relief (FRIMANN-DAHL).

In the cases we have seen the roentgenograms are entirely similar when the examination has been carried out correctly and quite completely. In order to interpret the pictures it is of course necessary to be entirely familiar with the roentgenological diagnosis of ileus.

## V. Treatment.

Caecal volvulus has been treated exclusively by operation. The principles of the treatment are to-day the same as were laid down by FALTIN in 1902: 1) The occlusion is remedied. 2) The emptying of the bowel is accelerated. 3) Peritonitis is guarded against. 4) It is sought to prevent recurrence.

As regards the technical details of the actual operation the following points must be noted. The incision must be made so large that the detorsion can, if necessary, be affected outside the ab-

domen, if the bowel is so greatly damaged that there is danger of rupture. A diarectal incision on the right side is most suitable. Spinal anesthesia ought to be employed for adults, as this form of anesthesia is, according to our experience best tolerated by ileus patients provided small doses are used. For children we employ narcosis.

The preparatory treatment is the same as for other forms of ileus: aspiration of the stomach with tube down in the duodenum, as well as supply of liquid and salt according to the degree of dryness and the intoxication in the particular case.

The occlusion is remedied by detorsion, which can easily be effected, provided we have a good view of the parts. This operation must be performed with caution and preferably outside the abdominal cavity, if it is suspected that the intestine is seriously damaged. The emptying of the bowel can be accelerated by inserting a long intestinal tube from the rectum. Less acceptable is the method which we often find mentioned, namely, puncturing of the large loop of the cæcum.

If the patient's condition is satisfactory and the bowel so far sound that there is no great danger of peritonitis, the question that arises for the operator when after detorsion he shall decide upon the measures to be employed to prevent recurrence is: which method shall I select? It is obvious that resection of the movable part of the colon, followed by ileotransversostomy, is the procedure which completely satisfies this requirement. Among the less radical methods employed we have cæcopexy, appendicostomy and cæcostomy.

To judge from the literature, appendicostomy is not very effective as a safeguard against recurrence. OHMANN has in his material three cases of recurrence, in one of which detorsion alone was performed, in the two others detorsion combined with appendicostomy. HARALD JAKOBSEN reports two cases of recurrence after the same method of procedure.

Cæcostomy is a rapid and easy operation. PRATT and FALLIS report three cases in which they performed cæcostomy and they state that it serves two purposes: Fixation and relief of strain on the bowel.

In one case recently operated by me I sewed up a large segment of the cæcum in a McBurney-incision, but without primarily opening it, as I reasoned in the same way as the above-mentioned Americans.

It has been asserted that suturing of the bowel to the anterior abdominal wall is not sufficient to prevent recurrence, as the sutures would often loosen again. This seems to me rather improbable, at any rate if the end of the caecal pole is fixed in a McBurney incision. In the above-mentioned case of mine X-ray examination with barium enema was made some time after the operation and the fixation was then found to be in order.

A small objection which I think may justly be made against caecostomy is that it involves some risk of incarceration of loops of the small intestine between the caecum and the outer abdominal wall, similar to what is occasionally seen after the Doleris operation for retroflexion of the uterus.

OHMANN, who has the largest number of cases collected from one hospital (the Viborg material), is of opinion that resection ought to be employed, even in less serious cases, more often than is now done. In the numerous publications from Russia in recent years, resection is also the method most employed. According to the principles adopted in our hospital for treatment of mechanical ileus we are reluctant to proceed to resection of the colon when it is not damaged. If our view of a caecal volvulus should be that resection ought to be employed in order to prevent recurrence, we will postpone that operation till later and at first only proceed to remedy the ileus.

The situation is different when the bowel is not in a sound state. The patient's general condition may be so bad that we can only think of making detorsion and drawing out the damaged part of the intestine. According to the statistics published (FALTIN, OHMANN, JACOBSEN) this is an unsatisfactory method, with high mortality, but it is possible that these statistics represent the worst cases. Here one should no doubt go very far in following the indications for resection and OHMANN says on this point that in those cases in the Viborg material where resection was made with successful result the intestines were highly gangrenous and the patients very ill, but the time of convalescence was shorter than after use of other methods. His opinion is that the operation shock depends more on the degree of intoxication than on the protracted operation.

In the few collective statistics published the mortality is reckoned at about 50 per cent (FALTIN 46 per cent, OHMANN 45 per cent, BEEGER 54 per cent).

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## VI. Conclusions.

The frequency of caecal volvulus increases in times of food-rationing, when the use of coarser flour, of potatoes in large quantities and of food-substitutes becomes general

Mesenterium ileocolicum commune is almost always a necessary condition for the occurrence of caecal volvulus

X-ray examination — survey of the abdomen combined with barium enema will as a rule supply the diagnosis

The treatment adopted ought to be détorsion with fixation in the cases when the bowel is not injured and ordinary resection with anastomosis in one stage or "obstructive resection" in two stages in those cases where the bowel is damaged

### Summary.

The author gives a survey of the conditions of occurrence, the clinical features and curative treatment of caecal volvulus and reports five cases of his own, in four of which X-ray examination was made before the operation

It is pointed out that the increased frequency of caecal volvulus noted in wartime with its food-rationing and during periods of famine is due to the use of coarser flour and abundance of voluminous food-substitutes, and it is also noted that mesenterium ileocolicum commune is almost invariably present The importance of the X-ray examination for the diagnosis is mentioned The examination comprises general survey pictures of the abdomen, taken in supine and in standing position, as well as horizontal radiation with the patient lying on his side if he is unable to stand As a rule the examination is supplemented by barium enema, with translumination The general survey pictures show a greatly distended colon loop (the twisted cæcum), usually with a large fluid level The barium enema tests reveal a stoppage in the passage at the site of torsion and usually a characteristic torsion relief at that place

As regards treatment, the author recommends detorsion, emptying of the bowel through an intestinal tube inserted from the rectum, as well as fixation of the cæcum in those cases where the bowel is not damaged, obstructive resection, or sometimes resection in one stage with ileotransversostomy in cases where the intestine is injured

### Zusammenfassung.

Der Verfasser gibt eine Übersicht über Entstehungsbedingungen, Klinik und Therapie bei Blinddarmverschlingung und berichtet von fünf eigenen Fällen, von denen vier vor der Operation röntgenuntersucht wurden

Es wird hervorgehoben, dass die Vermehrung von Blinddarmverschlingung, die man in Kriegszeiten mit der Lebensmittelrationierung, sowie bei Hungersnot beobachtet, auf den Gebrauch von grobem Brotmehl samt reichlich voluminöser Ersatzstoffe zurückzuführen ist. Auf das fast bestandige Vorhandensein von Mesenterium ileocaecale commune wird aufmerksam gemacht. Die Bedeutung der Röntgenuntersuchung für die Diagnose wird erwähnt. Sie wird mit Übersichtsbildern des Abdomens, in Rückenlage sowie in stehender — gegebenenfalls, wenn der Patient nicht stehen kann, in Seitenlage mit horizontaler Bestrahlung, ausgeführt. Die Untersuchung wird in der Regel mit Bariumklistern des Dickdarms unter Durchleuchtung komplettiert. Die Übersichtsbilder zeigen eine gewaltig erweiterte Dickdarmwinde (das torquierte Coecum), gewöhnlich mit einem grossen Flüssigkeitsspiegel. Die Bariumklisternuntersuchung zeigt Stockung in der Passage entsprechend der Verdrehungsstelle und in der Regel ein charakteristisches Verdrehungsrelief an dieser Stelle.

Im Bezug auf die Behandlung wird Detorsion, Entleerung durch vom Rectum eingeführte Darmsonde, sowie Fixation des Blinddarms in den Fällen, wo der Darm nicht beschädigt ist, empfohlen, sowie »obstruktive Resektion«, eventuell Resektion und Ileotransversostomie in einer Sitzung in den Fällen, wo der Darm kompromittiert ist.

### Résumé.

L'auteur passe en revue les conditions de l'origine, la clinique et la thérapeutique du volvulus du caecum, référant cinq cas particuliers, dont quatre sont examinés radiologiquement avant l'opération.

On souligne le fait que l'augmentation du volvulus du caecum, observée en temps de guerre avec son rationnement de nourriture aussi bien que sous une famine, est due à la consommation de farine panifiable plus égrugée ainsi qu'à celle des surrogats richement volumineux — ajoutez à cela que mesenterium ileocaecale commune est presque toujours présent.

L'importance de l'examen radiologique quant au diagnostic est mentionnée Cet examen est fait avec des images perspectives de l'abdomen, prises en decubitus dorsal, debout, éventuellement en decubitus latéral, les rayons étant dirigés horizontalement, en cas où le patient ne peut être debout L'examen est généralement complété par un lavement baryté sous translumination

Les images perspectives montrent un nœud de colon extraordinairement étendue (le caecum torquille), en général avec un bien grand niveau liquideux L'examen du lavement baryté fait voir un arrêt de passage, correspondant au lieu de torsion, généralement avec un relief de torsion caractéristique en ce lieu

A l'égard du traitement on recommande detorsion, vidage par une sonde d'intestin introduite par le rectum ainsi que fixation du caecum dans les cas où l'intestin n'est pas compromis — résection de Mikulicz (résection obstructive), éventuellement résection et iléotransversostomie dans une séance où l'intestin est compromis

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# The Opening Addresses Intended for the Cancelled Meeting of the Northern Surgical Society in Stockholm 1943.

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## Report of the Opening Addresses.

President Professor GUNNAR NYSTROM, Uppsala

Secretary General Professor E DAHL-IVERSEN, Copenhagen

The meeting which was to have taken place in Stockholm had to be cancelled on account of the general situation. The opening addresses, therefore, have been published on occasion of the 50th anniversary of the first meeting of the Northern Surgical Society in Gothenburg in July 1893. On the same occasion the Society published an *Index rerum et auctorum* of the discussions during the period 1893—1943 compiled by the Secretary General, Professor E DAHL-IVERSEN.

*Subject 1 On the Treatment of Varicose Veins and Haemorrhoids* Opening addresses by H F HARBITZ and ANDERS WESTERBORN

H F HARBITZ, *Molde, Norway*

Reports 113 cases of varicose veins and 112 cases of haemorrhoids, nearly all examined, treated, and followed up by the author himself in his capacity of chief physician of a hospital in a comparatively isolated district on the west coast of Norway, in More and Romsdal.

## I The Treatment of Varicose Veins.

In order to prevent progression and complications wide limits should be set to the *indications*. Varicosities of any extent and caus-

ing the slightest symptoms should be treated. In treating varicosities in women the cosmetic side of the matter should be taken into consideration.

*Contra-indications* The risk of deep thrombosis makes it absolutely necessary that the patient is ambulatory during the treatment. Pregnancy is not a contra-indication, if the disease causes discomfort. Previous deep thrombosis is not always a contra-indication. Venography and PERTHES' test may give information. A varicose phlebitis must be allowed to subside and wait for 2—6 months. Patients with cardiac or circulatory disturbances or infection must not be submitted to the treatment.

*Treatment* (1) *Injection* The solution used by the author is the Norwegian preparation "Etamolin" (monoethanol amino-oleate) 5 per cent. The author begins distally and injects 2—3 cc after having emptied the vein, if necessary 2—3 places on the same leg, repeating the injections every or every other day. An elastic bandage is applied and the patient is enjoined to walk. Injections are rarely performed to varicosities on the thigh, where resection and retrograde injection are preferred. 33 of the 113 cases were treated exclusively with injection, only the severe cases being admitted to the hospital.

(2) *Combined Ligature and Injection*

*Technique* All patients are hospitalized. Transverse incision into the lower part of the fossa ovalis under local anaesthesia. All tributaries and the saphenous vein are ligated with silk close to the sapheno-femoral junction. The vein is emptied by irrigation and a ureteral catheter is passed as far down as possible. Up to 2 cc of 5 per cent Etamolin, 1 part to 1 part water or 2 parts to 1 part water, is injected while the catheter is withdrawn. Elastic bandage. Patient allowed to walk. On the calf the thrombosis may become ineffective and in 50 per cent of the cases a re-injection must be made on the following days. In cases of bilateral involvement operations must be performed on each side with an interval of 2—5 days.

*Indications* (1) In cases of varicosities of some extent, (2) in case of positive TRENDLENBURG test, (3) in case of distinct varicosities on the thigh, and (4) in case of complications, especially ulcer cruris.

<i>Material Injection</i> 17 cases with <i>sodium salicylate</i>	
Followed up for 3—4 years	
Objective cure	0
Partial recurrence	7
Recurrence	10
16 cases with <i>Etamolin</i>	
Followed up for 1½—3 years, 8 for more than 1 year	
Objective cure	11
Improved	5
<i>Ligature + injection</i> in 70 cases	
11 cases with <i>sodium salicylate</i>	
Followed up for 3 years All subjectively well	
Objective cure	4
Improved (minor recurrences)	7
59 cases with <i>Etamolin</i>	
Period of follow-up not stated	
Objective cure	48
Improved	7
Unchanged	1
Recurrence in the small saphenous vein	3

1 woman of 74 had a pulmonary embolism after her return from the hospital, but recovered

10 cases of varicosities following deep thrombosis have been treated, 4 with injection, 6 with ligature + injection All improved.

During pregnancy the author suggests injection treatment and perhaps ligature + injection after delivery

## II The Treatment of Haemorrhoids

The author attacks the operative treatment which certainly has a large percentage of good results, but also a number of post-operative troubles like sphincteral disturbances, sensory disturbances, and ectropion of the mucous membrane The treatment applied by the author is the BLOND method of injecting a 30 per cent solution of quinine-urethane

The material consists of 112 cases of haemorrhoids treated during the years 1939—1942, 110 of which were followed up by the author himself for 3/4 to 4 years According to the author the

haemorrhoidal complex of symptoms is constituted by Acute, thrombosed, external haemorrhoids, internal haemorrhoids with pain and haemorrhage, later on sphincteral laxity and anal prolapse as well as haemorrhoids accompanied by anal fissure and pruritus. Abscesses and fistulas in the vicinity of the anus also are signs of a purulent thrombophlebitis in the haemorrhoidal veins, but their treatment is not dealt with.

*Technique* No sphincteral divulsion. With a short proctoscope 6—8 cc. of the solution are injected circularly and submucously inside the sphincter with a special syringe. Each stage comprises 5 injections of  $1\frac{1}{2}$  cc. = about 2 drops. A week should elapse between each stage and the treatment is completed in the course of 5—6 sittings. This method produces a good circular and submucous sclerosis, the shrinkage of which also causes submucous prolapses to subside.

*Acute, thrombosed external haemorrhoids* are treated under local anaesthesia with a small incision and emptying of the thrombus. Thereupon ordinary injection treatment of the ever present internal haemorrhoids.

*Anal fissures* are treated under local anaesthesia applied below the fissure with injection of a few drops of quinine-urethane below the proximal part, followed by ordinary injection treatment.

*Polypous varieties* of haemorrhoids are treated with excision.

*Pruritus* is treated with the ordinary injection technique followed by subcutaneous injection in the anal region proper, a few drops at a time, under local anaesthesia.

*Results* Complications. 112 patients treated with a total of 469 injections. No deaths. No cases of thrombosis, embolism, necrosis, or ulceration. Haemorrhage in 4 cases.

Follow-up of 108 patients (2 died of unrelated causes, 2 had pruritus, without haemorrhoids being demonstrable).

99 patients or 91.7 per cent were cured, 5 improved, 1 unchanged, and 1 had a recurrence.

From among 25 cases of submucous prolapse 19 were cured, 5 improved, and 1 had a recurrence.

From among 29 cases of concomitant fissures 27 were cured, 1 unchanged, and 1 had a recurrence.

From among 25 cases of concomitant pruritus 15 were cured for the pruritus, 5 improved, 4 unchanged, and 1 could not be traced.

No sphincteral or sensory disturbances.

A WESTERBORN, *Gothenburg*

### Varicose Veins

The author gives a brief review of the various methods of treatment Conservative, operative, injection treatment, and injection + high saphenous ligation Up to 1936 the last-mentioned method had been applied in 1200 cases with 4 deaths = 0.33 per cent W points out that a ligation may be applied with great accuracy close to the sapheno-femoral junction and to all branches, and that the patient should not be kept in bed, the cause of death as a rule being embolism The 4 above-mentioned cases were treated with bed rest The injection material preferred by the author is "Etolein"  $C_{17}H_{33}COON_3CH_2CH_2OH$  The intervention usually takes place at the polyclinic During pregnancy the injection treatment also is applied, supplemented with high ligation during the first 4 months without, however, using quinine-urethane and sodium salicylate In case of tendency to abortion, these medicaments should also be avoided The author has treated 30 pregnant women with gratifying results

#### *Contraindications*

- (1) Previous deep thrombosis which has not been recanalized  
With the modern technique deficient patency of the deep veins on the venogram is not a decisive factor
- (2) Bed rest from unrelated causes
- (3) Severe circulatory disturbances
- (4) Infections of any sort

The author reviews the different injection media and recommends Etolein The risk of allergy is considered to be very slight, Etolein injections having been applied about 45,000 times

The method of treatment most commonly in use at the Swedish hospitals is injection in the case of minor varicosities and injection + high saphenous ligation in the more severe cases

*Author's material* During the period 1931—39 829 patients had been treated, and in the course of a follow-up period of 5 years there were 60—70 per cent recurrences During recent years there has been an increase in the application of high saphenous ligation This method is considered to give satisfactory results in about 80 per cent of the cases

Major follow-ups have not yet been effected

### Haemorrhoids

Much stress is laid on prophylaxis. The different operative methods are reviewed. The author prefers JØRGEN JENSEN's modification of the WHITEHEAD operation.

*Author's material* During the period 1931—42 415 cases were treated with the above-mentioned modifications of WHITEHEAD's operation, i. e. excision of the individual haemorrhoids. A description of the technique follows. The author prefers intravenous anaesthesia which causes less post-operative pain than local anaesthesia. Bed rest for 4 days, whereupon a laxative is administered and the patient gets up.

292 patients were operated upon during the period 1931—40. After a follow-up of 2—5 years 265 sent a reply to a questionnaire. 90 per cent were symptomless or appreciably improved. No complications. In 2 cases incontinence of watery stools, and in 5 cases of flatus, though only in a mild form.

The author discusses the injection treatment and quotes other reports.

His own material only comprises 30 cases.

According to his opinion the injection method involves just as many complications and a major follow-up has not yet been effected.

### Subject 2 Urethral Injuries

Opening address by AARNE PELKONEN, *Helsingfors*

(H. DOHLEN, Oslo, was unable to send his contribution on account of the present situation.)

The author's material consists of 79 cases, partly war injuries and partly injuries in civil life, supplemented with a material from other hospitals and insurance companies. Besides, the author refers to his two previous papers on ruptures of the urethra from 1927 and 1938.

#### (I) Subcutaneous Ruptures

*Symptoms* Haematuria, perineal swelling, and urinary retention. Haematuria has been observed in 96.6 per cent of subcutaneous ruptures without and in 83.3 per cent of the cases with fracture of the bony pelvis. Complete urinary retention appeared in 37.8 per cent, and perineal swelling in 43.5 per cent of the cases.

*Treatment* Catheterization should, if possible, be performed at the hospital. In case it is necessary to do something before the admittance to hospital, bladder puncture should be preferred.

Ruptures in the posterior urethra are easily revealed by intravenous urography. On account of the risk of infection, it is inadvisable to inject the contrast medium through a catheter. In case of successful catheterization, indwelling catheter for 9—10 days. Control probing should be performed, considering that strictures may develop, even in mild cases. In case of unsuccessful catheterization, operation should be made immediately to prevent urinous infiltration.

Arciform incision in the perineum (the wound can be drained from the side). If the central part of the urethra cannot be found, cystostomy with retrograde probing. TIEMANN's or NELATON's catheter No. 22—25 is inserted and urethrography is performed with a few catgut stitches, not including the mucous membrane. If the diastasis is so extensive that it is impossible to apply suture, a "through" rubber tube is inserted, i. e. by means of a couple of sutures. TIEMANN's catheter is attached to a rubber tube introduced through the bladder. The wound is left open or partly sutured. The urine is kept sterile by lapis injections and urinary antiseptics.

Probing continued for 6—12 months.

## (II) *Open Wounds*

(1) In civil life open wounds are rare. They are often caused by the piercing of blunt instruments and accompanied by injury to the bladder, prostate, or rectum. Frequently it is impossible to suture the wound, in which case external urethrotomy must be made. Cystostomy and "through" catheter may often be applied with success. Colostomy in case of injury to the rectum.

(2) *In times of war*. The figures cannot yet be published. The open wounds are caused by all kinds of gunshots, mines, etc. and as a rule accompanied by injuries to other organs. A special characteristic of war rupture is that they are very severe and in most cases total. Frequently they are attended by shock for which reason they may easily be overlooked.

*Symptoms*. Desire to urinate and difficult urination on which occasion the urine as a rule only dribbles from the wound.

*Treatment*. Mild cases. Indwelling catheter and later probing. Severe cases. Urethrotomy and often retrograde probing through cystostomy. Often impossible to apply suture. A through drainage (TIEMANN + rubber tube). Changed after a lapse of a fortnight, thereupon every 10th day. The urine is kept sterile. Bougie treatment for 6—12 months.

*Strictures of the Urethra*

Strictures in civil life are often short, whereas war strictures are more extensive

If conservative treatment is impracticable, resection of the cicatricial tissue and urethrotomy. The author advocates indwelling catheter. If suture is unmanageable or unsuccessful, cystostomy and a 'through' catheterization. The urine is kept sterile, after-treatment with bougie

The results of injuries in civil life 91.8 per cent cured, 4.1 per cent improved, and 4.1 per cent died

Out of 63 patients who were followed up, 47 = 74.6 per cent were symptomless. Indwelling catheter does *not* give rise to strictures

In case of war injuries cystostomy is performed in 80—90 per cent

*Subject 3 Arthritis deformans from a Surgical and Orthopedic Point of View*

Opening addresses by KARL LEHMANN, *Copenhagen* and GUNNAR WIBERG, *Stockholm*

KARL LEHMANN

Without dwelling on history and literature studies, the author exclusively deals with the methods in use in Denmark to-day and the results obtained. 789 cases of arthritis deformans were treated at the Orthopedic Hospital, Copenhagen during the period 1935—1939, 5 per cent of the patients were ambulatory. The author's investigations only apply to the hospitalized patients. The follow-up has chiefly been effected by questionnaires, but besides a number of patients (190) were after-examined at the hospital once a year.

The most important symptom is pain, and the most important guide is the patients' own views on the effect of the treatment. Thereupon the author goes through the various joints, one for one (1) *Hip joint*, 110 cases

*Physical therapy and X-ray therapy* have proved to be of very little effect on arthritis deformans (presumably better in the case of chronic arthritis)

*Traction treatment* Temporary improvement in quite a number of cases

*Infoatio* 46 per cent distinctly improved Follow-up extending over 4—8 years (82 cases) The reason for the effect is not known, but presumably it is ingrowth of vascular granulation tissue and better supply of blood to the femoral head The mobility is not reduced, in some cases even improved The improvement is most conspicuous in cases where the symptoms have been present for a number of years

The rare forms of secondary arthritis, e g following congenital subluxation, epiphysiolysis, and Calvé-Perthes disease, seem to be especially responsive to this kind of treatment

*Arthrodesis* has given gratifying results (11 patients) These few cases do not allow of an estimation as to the best method

From *arthroplasty* (12 cases, particularly with bilateral involvement and very reduced mobility) the results have not been so good Interposition of fascia, muscle, or coffer dam is recommended

(2) *Knee joint*, 29 cases

One case only following a fracture The treatment consisted in correction of the contracture Bandage or resection Arthroplasty has not been attempted

(3) *Ankle joint*, 9 cases, 6 of which following fracture of the malleolus

Immobilization in a bandage usually has failed to relieve the patient of pain Arthrodesis in 4 cases, with a favourable result in 3, the 4th case only after supplementary drilling Arthrodesis is a good method of treatment

(4) *The joints of the foot* The subtaloid joint and the joints of Chopart, 33 cases

Chiefly severe cases of flatfoot and fracture of the calcaneum Lifts in the shoes and orthopedic footwear aid in a number of cases Arthrodesis good results The metatarso-phalangeal joint of the great toe is not included

GUNNAR WIBERG

Material from the Orthopedic Clinic, Stockholm

After a short introduction on bandage- and operative treatments the author reviews the various joints, one for one

(1) *Hip joint* A brief historical review of the hip joint resection reveals how the unsatisfactory results lead to the various forms of arthroplasty with a more economic resection Mention is made of the various forms of arthroplasty, especially the SMITH-

PETERSEN method of inserting an alloplastic disc into the joint (for the present a metallic alloy, Vitallium)

Own material 10 cases The author dwells on the details of the technique and after-treatment and gives brief case records of 8 cases The results give reason for optimism

*Arthrodesis* 48 cases during the period 1935—41 with various methods The result usually satisfactory

According to the literature *drilling* has given conspicuous results Lacks own material

Finally a brief mention of the method of acetabuloplasty

(2) *Knee joint* Detailed discussion of patellar chondromalacia and its surgical treatment, chondrectomy, patellaplasty, and patellar extirpation as a prophylactic treatment of arthritis of the knee joint

(3) *Ankle joint* Arthrodesis in the case of old fractures of the calcaneum, but not in case of fresh ones From among 11 cases 9 were cured and 2 improved

1st metatarso-phalangeal joint Resection of the 1st phalanx has given satisfactory results No statistical material

Brief mention of arthritis of the shoulder, elbow, wrist, and finger joints as well as the jaw

#### *Subject 4 On the Treatment of Pseudarthrosis*

Opening addresses by SVEN KJÆR, *Copenhagen*, and GUSTAV LEVANDER, *Köping, Sweden*

SVEN KJÆR

In Denmark pseudarthrosis occurs in 1 per cent of all fractures of the extremities (apart from hand, foot, and intra- and juxta-articular fractures) At most 10 pseudarthroses of the crus annually

Prognosis and treatment being different, it is important to distinguish between pseudarthrosis and delayed consolidation X-ray findings are decisive, but in border-line cases it is a matter of discretion

The author uses WERNER-BLOCH's classification (1940)

(1) Pseudarthrosis caused by delayed, osseous degeneration due to appreciable anatomical disturbances at the site of the fracture (a) Defect pseudarthrosis (b) Pseudarthrosis following interposition

- (2) Pseudarthrosis caused by disturbances in the normal regenerative process of the bone Split pseudarthrosis The causes may be general or local

*Material.* During the period 1931—40 the Orthopedic Hospital in Copenhagen treated 44 pseudarthroses + 13 delayed consolidations of the long bones and clavicular, thereamongst 24 pseudarthroses and 12 delayed consolidations of the crus

All patients were followed up for at least 1½ years The results have been divided into 4 groups excellent, good, fair, and poor

4 out of 15 pseudarthroses of the upper extremities were operated upon, 3 good, 1 poor The remaining 11 were treated with bandage with a gratifying functional result 2 patients with pseudarthroses of the femur did not wish to be submitted to treatment Bandage treatment unsatisfactory

A further analysis has been limited to the pseudarthroses and delayed consolidations of the crus

- (1) Delayed consolidation 12 cases — 2 untreated cases healed in 7 and 12 months respectively — 10 treated cases gave 8 excellent and 2 good results The treatment in the uninfected cases was drilling with the BECK method or bandaging 3 infected cases were treated with the ORR method Only one fibular osteotomy

The author advocates active treatment as soon as the union is delayed

- (2) Pseudarthroses 24 cases, 15 split pseudarthroses, 7 defect pseudarthroses, 2 unclassified The operation requires the insertion of a whole bone graft, sometimes supplemented with osteoperiosteal flaps wrapped around the graft The infected cases were treated with the ORR method

For material see p 299

Bone graft	11	<div> <div>7 excellent</div> <div>2 good</div> <div>1 fair</div> <div>1 poor</div> </div>
Drilling	2	<div> <div>1 excellent</div> <div>1 poor</div> </div>
Osteosynthesis	1	1 fair
Bandage	7	<div> <div>1 good</div> <div>6 poor</div> </div>
Amputation	2	

The number of pseudarthroses in Denmark appears from various statistics. In the case of fractures of the crus the rate is 1 per cent. This relatively low figure presumably is due partly to the fact that severe complicated fractures are in the minority and perhaps that osteosynthesis is not so extensively used.

Finally some general remarks on the principles and methods of treatment.

The last 10 years' results are given in the form of statistical tables. It appears that good results, i. e. more than 90 per cent healing, have been obtained by bone grafting, spongiosa filling by the MOTRI method, and bone splintering by the KIRSCHNER method.

Reviewing the pathogenesis the author emphasizes the importance of biological as well as mechanical elements.

In the final discussion the author summarizes his principles of treatment.

(1) On suspicion of delayed union (8 weeks in the case of fractures of the crus) drilling by the method of BECK.

(2) Defect pseudarthroses should be treated, as soon as it has been ascertained that union cannot take place.

(3) Infected cases should be treated by the ORR method.

Application of whole bone graft in the case of defect pseudarthrosis, splintering, MOILI, whole graft, or slide-graft in the case of split pseudarthrosis.

GUSTAV LEVANDER

### (1) *Introduction*

Mainly on the basis of his personal experience and a material collected from Swedish hospitals the author reviews the modern knowledge about bone regeneration and union of fractures. In his opinion the cardinal point is to arrive at directions for the therapy by means of the above as well as theoretical assumptions.

### (2) *Bone Regeneration*

(a) *Periosteum*. When transplanting periosteum the graft dies, and 5 days later bone formation may be seen in the newly formed mesenchyma in the surroundings — not by cell division in the cambium layer.

(b) *Bone marrow*. In this case too the graft dies and the bone is formed from the surrounding mesenchyma.

(c) *Corticalis* The greater part dies Regeneration from the surroundings Never regeneration from application of boiled bone or calcium injections

(d) *Spongiosa* Less powerful stimulation Displays greater vitality and keeps alive longer than corticalis

(e) *Extract* The experiments of the author and ANNERSTEN have revealed the presence in bone and marrow of an ingredient — soluble in alcohol — which, when used in the form of injections, may stimulate the mesenchyma to form cartilage and bone

This induction doctrine contains a general explanation of the processes of bone healing and pathological bone formation, heterotopy, etc it being presumed that the principle circulates with the blood stream and is excreted with the urine A further explanation then follows The author stresses the importance of restricting the term periosteum to the connective tissue surrounding the bone, the cambium layer being the mesenchymal zone of growth to the bone tissue The periosteum proper plays no part in bone regeneration

There follows a brief survey of the material derived from a number of Swedish hospitals during the years 1939—40 It consists of pseudarthroses, of the diaphyses of the long bones, only counting those submitted to operation

289 cases with 406 operations

The author classifies the various methods of operation into 3 main groups

- (1) Freshening of the bone ends with or without fixation
- (2) Activation of the osteogenesis
- (3) Bone grafting

A Freshening with or without osteosynthesis in 26 cases

Osteosynthesis 42 per cent failures

B Mobilization of osteogenetic power

(I) Drilling 117 cases Healing in 32 per cent A number of these actually being cases of delayed union, the effect on the whole is rather doubtful

(II) Splintering by the KIRSCHNER method 18 cases, 61 per cent healing

C Bone grafting Having given a brief survey of the various methods the author reviews the material

(I) *os purum* 13 cases — 0 healed

*os novum* 6 » — 3 not healed

3 healed slowly

## (II) Live bone tissue

(a) *Graft*

93 fractures of the crus = 63 per cent healed All cases 155 = 58 per cent healed

(b) *Spongiosa*

22 fractures of the crus = 70 per cent healed

(c) *Combined methods*

Graft + flaps of spongiosa 11 cases = 10 healed

*Discussion and Results*

Os purum did not result in healing in any case

Os novum keenly criticized

(1) The most complicated of all methods

(2) No guarantee that newly formed bone tissue is transplanted, its formation at least being very slight

(3) A period of two months must elapse before the formation of os novum can be completed Unnecessary waste of time

(4) The results are far from encouraging

Therefore, a living graft should be used The exact fixation seems to be of less importance Experiments have revealed that a narrow zone of fresh bone tissue is formed around the surface of a piece of implanted corticalis, whereas the graft itself dies After LEVER'S and ALBERT'S methods the formation of new bone mainly takes place inside the bone ends, but in the pseudarthrosis split proper the formation of new bone is only slight The osteogenetic force inside the graft is not properly utilized The freshened bone ends are poor osteogenetics

The healing is slow and requires long immobilization, making the stiff joints and muscles stiffer still

The author therefore advocates freshening of the bone ends, loose packing of the space with chips of corticalis and perhaps fixation with rustless metal wire and plaster of paris Healing in 83 per cent of the cases within an average period of 3 3 months

*Prophylaxis*

*Comminuted fractures with complications* constituted 40 per cent of the cases

(1) It is inadvisable to use too heavy a wire traction In the case of fractures of the crus 1—2 kilos are sufficient during the first few days

(2) The haemostasis should not be too thorough It is important that plenty of clots be left behind Perhaps injection of blood

into the site of the fracture a few days later, when the danger of infection has passed

- (3) Loose fragments should not be removed unless it is absolutely necessary

*Primary osteosynthesis* constituted 25 per cent of the cases

It is wise to use as little fixation material as possible A single drill wire made of rustless steel through the corticalis

Simultaneously with the open replacement, mobilization of the osteogenetic power of the bone ends

*Optimum time for the intervention* Do not wait too long In case normal firmness is delayed for much more than 2—3 months, an intervention should be contemplated

*Infected fractures* Should not either be kept waiting too long If the infection has subsided, the operation can soon be performed (Table p 361 )

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## Intradural gelegener Diskusprolaps.

Von

O HULTÉN

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Es liegt in der Natur der Sache, dass Diskusprolapse mit *extraduralen* Tumoren verwechselt werden können. Dieser Irrtum wurde allgemein begangen, bevor man sich über die Entstehungsart dieser Gebilde klar war. Dass sich ein Diskusprolaps einen Weg durch die vordere Wand der Dura bahnen und *intradural* enden kann, sollte man wohl für unwahrscheinlich halten, aber dass dies möglich ist, zeigt der nachstehend mitgeteilte Fall. Die Verwechselung mit Tumor liegt dann noch näher.

Journal 2088/43 39-jähriger Mann, der vor 10 Jahren eine akut auftretende Ischias bekam, ohne dass er sich einer Ursache derselben entsinnen kann. Nach Kochsalzinjektionen und Bädern besserte sich der Zustand. Ein Jahr später nahmen die Beschwerden zu, verschwanden aber nach Baderbehandlung wieder. Danach war er gesund und konnte sogar 1942 ohne Schwierigkeit Militärdienst tun. Im Februar 1943 erkrankte er mit Stechen und Schmerz in der rechten Hüfte und auf der Aussenseite des rechten Oberschenkels. Unmittelbar danach stellten sich Parästhesien im ganzen rechten Oberschenkel und Unterschenkel ein. Hin und wieder wurden die Zehen des rechten Fußes empfindungslos. Seit dem Mai 1943 fühlte er Schwäche im rechten Fuss, und in den Tagen vor der Aufnahme ins Krankenhaus (21. 5.) konnte er sich nicht auf den Fuss stützen. Gleichzeitig kamen Schmerz und Schwäche im linken Bein hinzu. Miktionsbeschwerden traten gleichzeitig auf, und am letzten Tage konnte er die Harnblase nicht entleeren. Bei der Aufnahme in die Medizinische Abteilung des Krankenhauses am 21. 5. 1943 wurden 1300 ccm mit dem Katheter entleert. Zu dieser Zeit bestand eine komplette Paralyse des rechten Fußes, massige Parese des rechten Beines im übrigen sowie leichte Parese des linken Fußes und Kniegelenks. Der Umfang des rechten Ober- und Unterschenkels war 4 bzw. 3 cm kleiner als auf der linken Seite. Die Sensibilität war auf der rechten Seite in den Segmenten L V—S V und auf der linken in S II—S V herabgesetzt. Die Patellarreflexe waren lebhaft (rechts = links). Achil-



Abb 1 Mikroskopisches Bild des intradural gelegenen Diskusprolapses

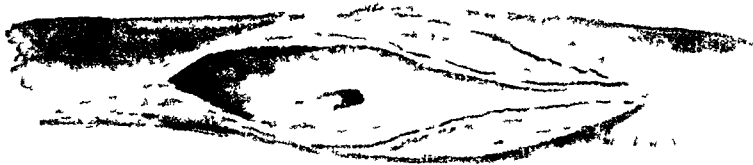


Abb 2 a) Der Diskusprolaps nach Eröffnung der Dura b) Der Stiel des Prolapses setzt sich in einen Kanal in der Intervertebralscheibe fort c) Der »Bruchkanal« tritt nach dem Fortnehmen des Prolapses deutlich hervor



lesreflex fehlte auf beiden Seiten Lasègue 45° (rechts = links) Lumbalpunktion zeigte normalen Druck, in der Flüssigkeit keine Zellenvermehrung, Gesamterweiss = 0.45 ‰

Man nahm eine Kontrastuntersuchung mit Jodipin vor, von dem 2 ccm subokzipital eingespritzt wurden. Das Kontrastol sank in stehender Stellung rasch bis L IV, wo es stehenblieb. Seine distale Grenze reichte bis in die Höhe des unteren Drittels des Wirbelkörpers von L IV, und die Grenzlinie bildete einen nach unten konkaven Bogen, was auf einen Tumor in diesem Gebiet deutete. Am 1. 6. wurde Pat. zwecks Operation unter der Diagnose Tumor medullae spinalis auf die Chirurgische Abteilung verlegt.

*Operation* (HULTÉN). Nach Laminektomie sah man einen blauweissen, kirschgrossen Tumor durch die blossgelegte Dura schimmern, der sich bei Palpation knoipelhart anfühlte. Nach Eröffnung der Dura trat der Tumor als eine grobfaserige, gelbweisse Masse hervor, die zwischen den plattgedruckten Caudanerven lag und mit einem Stiel an der vorderen Wand der Dura festsass. Als man den »Tumor« vorsichtig zur Seite hielt, zeigte sich, dass sich der Stiel in einen Kanal hinein fortsetzte, der eine Weite von 2 × 4 mm hatte und sich 42 mm in die Intervertebralscheibe hineinerstreckte. Die fibrose Masse lag lose und konnte herausgehoben werden. Man kratzte den Kanal mit einem schiefen Löffel aus, erhielt aber keine Ausbeute. Mikroskopisch bestand die herausgeschaffte Masse aus Nucleus-pulposus-Gewebe, welches teilweise nekrotisch war.

Die Heilung erfolgte ohne Komplikationen. Nach ein paar Wochen begann Pat. die Harnblase kontrollieren zu können, und nach 2 Monaten konnte er recht gut mit zwei Stocken gehen. Nach einem halben Jahr konnte er 1½ km mit Stocken gehen. Das linke Bein war ganz wiederhergestellt, aber die Kraft des rechten war herabgesetzt, und das Fussgelenk sowie die Zehen waren bewegungsunfähig. Die Sensibilität hatte sich gebessert, war aber noch immer in gewissen Partien des rechten Beines sowie im Perineum herabgesetzt und fehlte in der lateralen Hälfte des Fusses ganz, jedoch meint Pat., dass zu diesem Zeitpunkt Empfindungen auch in diesem Gebiet aufzutreten begonnen hatten. Lasègue 90° (rechts = links). Die Besserung schreitet 1 Jahr nach der Operation noch immer fort.

Der Fall ist von Interesse, teils weil der Diskusprolaps sehr schwere Nervenerscheinungen in Form von Paraplegie mit Blasenlahmung hervorgerufen hat, teils weil sich der Prolaps einen Weg in den Duralsack gebahnt hat und frei zwischen den Nervenwurzeln der Cauda lag. Paraplegien kommen bisweilen bei Diskusprolapsen vor, aber einen *intradural gelegenen Diskusprolaps* habe ich bisher nicht beschrieben gefunden. Dass der Diskusprolaps die vordere Durawand durchbrechen konnte, dürfte sich daraus erklären, dass die Dura aus irgendeinem Grunde mit der Zwischen- scheibe verwachsen war. Als die Nucleus-pulposus-Masse durch

die Oberflächenschicht der Zwischenscheibe durchbrach, sprengte sie auch die Durafasern auseinander, die mit dieser Oberflächenschicht verwachsen waren. Die Ursache der Verwachsung zwischen der vorderen Durawand und der Zwischenscheibe kann ich nicht angeben, wahrscheinlich handelte es sich um eine angeborene, anatomische Anomalie.

### **Zusammenfassung.**

Der Verfasser beschreibt einen operierten Fall von intradural gelegenem Diskusprolaps, der Paraplegie mit Blasenlahmung hervorrief.

### **Summary.**

Report of a case of intradurally situated disc prolaps causing paraplegia and paralysis of the urinary bladder which was successfully removed by surgical intervention.

### **Résumé.**

L'auteur décrit un cas d'hernie intradurale d'un disque intervertébral ayant causé une paraplégie avec paralysie de la vessie et dont l'excision donna d'heureux résultats.

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Aus dem Loimaaer Bezirkskrankenhaus und aus dem pathologisch-anatomischen Institut der Universität zu Helsinki  
(Chefarzt Dr med et chir EINO E VUORI)

## **Die Lymphadenitis mesenterialis juvenilis im Lichte der bakteriologischen, pathologisch- anatomischen u. a. Untersuchungen an 100 mit der Appendektomie behandelten Fällen.**

Von

EINO E VUORI

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Schon vor etwa 10 Jahren, als ich in den Tuberkulosedistrikten Sudpohjanmaas wirkte, richtete ich meine Aufmerksamkeit auf eine unter Appendizitissymptomen auftretende Krankheit, bei der jedoch weder an der Appendix noch am Coecum oder Ileum eine augenfällige Veränderung zu beobachten war, wohl aber im Mesenterium reichliche solitare, knorpelfarbige, durch das Peritoneum durchscheinende, vergrößerte Lymphdrüsen angetroffen wurden. Ich hielt die Krankheit damals für tuberkulös, und meine Vermutung bekam einen Anhalt in dem mir zufällig in die Hand geratenen Schrifttum. An den betreffenden Patienten waren indessen kaum jemals Symptome einer Tuberkulose anderer Organe nachzuweisen. Ich begann deshalb allmählich an der Stichhaltigkeit meiner Vermutung zu zweifeln. Ein besseres Eindringen in die Literatur erwies, dass die Natur des Leidens durchaus nicht völlig geklärt war. Als dann meine Erfahrung mit der zunehmenden Zahl der von mir behandelten Fälle wuchs, verwarf ich meinen früheren Standpunkt und gelangte zu der Überzeugung, dass es sich hier wenigstens um eine Krankheit mit selbständigem klinischem Bild, möglicherweise sogar um eine vollkommen selbständige Krankheit, handelte, deren Ätiologie unklar, aber keineswegs tuberkulös war. Diese meine Ansicht, die ich am 1. J. 1942 auf der Frühjahrsversammlung des Finnischen Chirurgenvereins

in einem auf 30 Fällen basierenden Vortrag geäußert habe, will ich im folgenden aufgrund meines auf 100 Fälle angewachsenen Materials verteidigen

## Über die Nomenklatur und die Auswahl meines Materials.

Die Krankheit ist schon seit dem Jahre 1723 bekannt, wo SYDENHAM als erster darüber schrieb. Obgleich sie seitdem und zumal in den letzten 20 Jahren Gegenstand zahlreicher Untersuchungen gewesen ist, scheint man sich nicht einmal über ihr klinisches Bild, geschweige denn über ihre Ätiologie im Klaren und einig zu sein. So findet man noch, insbesondere im amerikanischen Schrifttum, unter dem Namen Lymphadenitis mesenterialis durch die verschiedenartigsten Krankheiten bedingte Schwellungszustände der mesenterialen Lymphdrüsen vereinigt, z. B. durch Tuberkulose (BELL, BOWMAN, BRAITHWAITE, CLUTF, FOSTER jr., DE LA MARNIÈRE, STRUTHERS usw.), Appendizitis und Ileitiden (KLEIN, NOESSKE, POP, STROMBACK usw.), Paratyphus (STROMBACK) und sogar durch Neoplasmen bedingte (FOSTER jr.). Einige Forscher haben offenbar gerade deswegen (FOSTER jr.), aber teilweise auch zum Unterschied von der tuberkulösen Form (SCHRAGER) das Attribut *nonspecifica* gebraucht. In nicht-tuberkulösen Fällen, in denen fast ausnahmslos leichtere oder schwerere pathologische Veränderungen am unteren Ileum, Coecum oder an der Appendix wahrzunehmen sind, sind die Drüsen zahlreich, durch das gequollene Peritoneum schlecht sichtbar — selbst wenn sie gross und vorgewölbt sein sollten — trübe verfärbt und oft stark hamorrhagisch. In ihrer Umgebung bemerkt man eine deutliche Periadentitis, und häufig sind auch die zuführenden Lymphgefäße entzündet und erscheinen als gerötete Strange. Bisweilen bilden die Drüsen auch Konglomerate. Für einen derartigen deutlich regionalen und sekundären Prozess wird die Bezeichnung *Lymphangitis et lymphadenitis peritonealis seu mesenterialis* gebraucht (PRIBRAM, BRÜNING, KLEIBER und SCHNITZLER). Die *Lymphadenitis mesenterialis tuberculosa* ist bei der Laparotomie leicht erkennbar, weil sich fast immer verkäste oder sogar verkalkte Drüsen darunter befinden. Auch vor der Operation erkennt man sie oft als solche, ausser an der Anamnese und dem klinischen Krankheitsbild auch palpatorisch an den ungleichmassigen Drüsenkonglomeraten von denen gewöhnlich nur einige wenige, bisweilen nur eins vorhanden sind. Die zu den obener-

wahnten Gruppen gehorenden Adenitiden (6 + 1) habe ich aus meinem Material fortgelassen und lediglich die in der Einleitung geschilderten »reinen kryptogenetischen« Falle mit aufgenommen. Weil sie nur bei jungen Personen und vorwiegend bei Kindern vorkommen, halte ich es für motiviert, zum Unterschied von den anderen Formen, die Bezeichnung *Lymphadenitis mesenterialis juvenilis* (im Text abgekürzt L-ad m j) dafür zu gebrauchen. Ein ähnliches Material ist früher nur von GULEKE (26), IRELAND (22), LAWEN (17) und MARSHALL (48 Falle) gebracht worden. Dagegen durfte ein grosser Teil von den Fällen BROWN's (30), HEDBERG's (156), SENNELS' (114) und HEUSSER's (40) nicht genau zu derselben Gruppe gehören, weil sie ja angeben, dass am Darm recht allgemein eine Rotung vorlag und die Drüsen »hellrot« waren, während an der Drüsenoberfläche auch in den allerakutesten Fällen dieses Materials höchstens eine spärliche Kapillarennetzinjektion wahrzunehmen war. Das Material der übrigen Forscher ist sehr verschieden und enthält meistens überwiegend tuberkulöse Falle. Deswegen sind die Vergleiche hauptsächlich mit den Angaben der obenerwähnten Autoren angestellt worden.

### Eigene Untersuchungen.

Mein Material umfasst 100 zu verschiedenen Gesellschaftsklassen gehörige Patienten, von denen jedoch die meisten der Ackerbaubevölkerung angehörten. In diesem waren eine 3- und eine 2-köpfige Geschwisterschar vorhanden. Es handelte sich um 41 Knaben und 59 Mädchen im Durchschnittsalter von 9 Jahren.

Tabelle Nr. 1

Das Alter der Patienten

3—4 Jahre	4—5	5—6	6—7	7—8	8—9	9—10	10—11	11—12	12—13	13—14	14—15	15—16	16—17	17—18	18—19	19—20	Über 20
1	4	5	14	9	11	12	12	9	5	5	3	1	5	1	1	0	3

Wie aus der Tabelle Nr. 1 erhellt, waren die 6—12-jährigen am reichlichsten vertreten. Ich habe sämtliche Falle persönlich behandelt: die Appendix und 2—4 vergrösserte Lymphdrüsen aus der Gegend des Ileocoecalwinkels exstirpiert; wobei ich die letzt-

erwähnten vor der Durchtrennung der Appendix steril entnahm. Die nur an ihrer Durchtrennungsstelle geklemmte Appendix rollte ich am Boden einer Salbenbuchse von geeigneter Grösse auf, wobei ich als fixierendes Gewicht einen Wattebausch benutzte, auf den Formalinlösung gegossen wurde. Wegen einer zu langen Aufbewahrung in der Fixierflüssigkeit verdarben einige Präparate. Die Färbung wurde nach der Haematoxylin-van Giesson- und der Haematoxylin-Eosinmethode vorgenommen. Die *histologische* Untersuchung habe ich unter Anleitung von Prof. ARNO SALÉN, dem Vorstand des Pathologisch-anatomischen Institutes der Universität Helsinki, ausgeführt, dem ich bei dieser Gelegenheit meinen Dank aussprechen möchte. Ferner wurden 1—2 Drüsen im Sero-bakteriologischen Institut derselben Universität *bakteriologisch* untersucht. Leider wurden dort „infolge des Krieges“ 24 aufeinanderfolgende Präparate ununtersucht fortgeworfen. Die Art und Zahl aller ausgeführten Untersuchungen gehen aus der Tabelle Nr. 2 hervor.

Tabelle Nr. 2

<i>Art und Zahl der ausgeführten Untersuchungen</i>	
Röntgenuntersuchung der Lungen	100
Pirquet Tuberkulinreaktion	96
Senkungsreaktion nach Westergren	80
Hgb %, Zählung der Erythrozyten und Index	87
Differenziertes weisses Blutbild	82
Gewöhnl. Bakterienkulturen der Lymphknoten	65
Lowenstein kultur	62
Meerschweinchen Impfung	32
Histologische Untersuchung	92
» » des Appendix	98
Probefrühstück	9
Widal Reaktion	2
Bang Reaktion	2

### Anamnese.

An vorausgegangenen Infektionen sind vorgekommen Enteritis acuta 3mal, Bronchitis ac 3mal, Pertussis 2mal und Pneumonia (crouposa<sup>2</sup>), Tonsillitis recidivans, Nephritis ac, Erythema nodosum, Influenza, Morbilli und Parotitis epidem je einmal.

Eine Häufung von Katarrhen der oberen Luftwege (ADAMS & OLNEY, HEDBERG, SCHRAGER), rezidivierenden Tonsillitiden (PRIBRAM, KLEIBER, BEROVICH & TRONGÉ) oder Darminfektionen (KLEIN) ist also in der Anamnese nicht zu beobachten gewesen.

Dies ist auch sehr begreiflich, weil die erwähnten Forscher, nach ihren Operationsbefunden zu schliessen, gerade die L-ad m -Formen untersucht haben, die ich absichtlich aus meinem Material fortgelassen habe

Die *Symptome* setzen gewöhnlich allmählich ein Das Kind fängt an, über Leibschmerzen zu klagen, die wenigstens anfangs ganz schwach und von kurzer Dauer sind und meistens in der Umgebung des Nabels empfunden werden Sie pflegen im Anschluss an eine lebhaftere Bewegung, z B nach Laufspielen, nach dem Heimweg aus der Schule oder nach Radfahren aufzutreten Sie können auch nach den Mahlzeiten einsetzen, sind aber dann von der Qualität der Nahrung unabhängig Während des Schmerzanfalls setzt sich das Kind gern für einen Augenblick gekrümmt auf die Erde und ist nach Verlauf einiger Minuten wieder ganz wohl auf Allmählich verliert es den Appetit, magert ab und kann auch reizbar werden Oft treten die Anfälle periodisch auf und gruppieren sich zu Schmerzphasen von einigen Tagen oder 1—2 Wochen Dauer, zwischen denen symptomfreie Zeitspannen von einigen Tagen oder Wochen, in der ersten Zeit sogar von Monaten, vorkommen können Ehe man zum Arzt seine Zuflucht nimmt, sind jene gesunden Intervalle jedoch zumeist immer kürzer geworden, so dass fast täglich und bisweilen sogar mehrmals am Tage Beschwerden empfunden werden Fieber besteht in der Regel gar nicht oder beläuft sich auf höchstens einige Zehntel Grad Erbrechen kommt recht selten vor, Durchfall und rennenswerte Verstopfung kaum je

Viel seltener beginnt die Krankheit mit einem schweren Anfall von einem oder mehreren Tagen Dauer, der mit seinen heftigen Leibschmerzen täuschend an einen akuten Appendizitis-Anfall erinnert, und unter dieser Diagnose gelangen die Fälle gewöhnlich ins Krankenhaus Erbrechen kommt bei dieser akuten Form ziemlich oft, aber Durchfall selten vor

Eine dritte Gruppe bilden die Fälle, in denen sich nach dem oben geschilderten akuten Beginn rezidivierende akute Anfälle entwickeln, also *Casus chronici pro tempore acuti seu recidivantes* Die Grenze zwischen dieser und der Gruppe der chronischen Fälle ist natürlich etwas diffus

Vielleicht gerade aus diesem Grunde haben sich von den älteren Erforschern der L-ad m BROWN und MARSHALL mit einer Einteilung in akute und chronische Fälle begnügt GULEKE wiederum hat seine Fälle in solche eingeteilt, die mit den Symptomen der Appendizitis,

des Magen- und Darmgeschwürs bzw mit unbestimmten Symptomen einhergehen HRUSSER, IRLAND und SENALLS haben gar keine Gruppierung aufgrund der Art des Beginns oder der Symptome vorgenommen Von den Autoren, die ein gemischtes Material vorgeführt haben, haben z B BOWMAN und BRAITHWAITE auch die Einteilung in akute und chronische Formen benutzt, andere haben sonstige Gruppen nach der Beschaffenheit der in ihrem Material vorliegenden Fälle aufgestellt, z B ROSFABURG die Gruppen foudroyante und akut eitrige, WILENSKY & HAHN die Gruppen einfache, eitrige und tuberkulose

Die Angaben über die *Dauer der Beschwerden* können natürlich nicht ganz exakt sein, denn die Eltern der Kinder haben sich ja, zumal in den alleilangwierigsten Fällen, nicht an das genaue Datum des ersten Auftretens der leicht und gleichsam einschleichend beginnenden Schmerzen erinnern können Deswegen konnte die Tabelle Nr 3 in ihren Zeitangaben nicht präziser gemacht werden

Tabelle Nr 3

*Die Dauer der Beschwerden*

$\leq 14$ T	ca 1 M	ca $\frac{1}{4}$ J	ca $\frac{1}{2}$ J	ca 1—2 J	> 2 J
14	8	12	22	22	22

**Status praesens.**

*Habitus und Ernährungszustand* Meine Patienten sind im allgemeinen mager, ziemlich blass sowie von schwachem und mattem Aussehen gewesen Dasselbe geben auch viele frühere Forscher, z B GULEKE, HLUSSEK und MARSHALL an 75 % der Patienten waren sogar so mager, dass die Rippen, die Zacken des Serratus anterior und die Inskriptionen der geraden Bauchmuskeln deutlich unter der Haut sichtbar waren Nur 3, sämtlich Mädchen, waren ziemlich fett Keines derselben hatte jedoch einen als lymphatisch anzusprechenden Habitus Leider wurde der Ernährungszustand nur nach Augenmass, nicht durch Wagung oder andere Messungen bestimmt, die für eine zahlenmassige Darstellung des Missverhältnisses nötig gewesen waren

Die *Form des Bauches* war bei den meisten eingesunken, besonders im Liegen Nur vereinzelte wiesen ein aufgetriebenes Abdomen auf

Eine echte *reflektorische Muskelspannung* kam nicht einmal in den allerakutesten Fällen vor Der Tonus der Bauchmuskeln war jedoch grösser als normal, sodass das Palpationsgefühl ungefähr das gleiche war, das man beim Untersuchen des Bauches in Fällen von nicht-exsudativer tuberkulöser Peritonitis erhält

Das Fehlen der Muskelspannung wird auch von MARSHALL erwähnt. Dagegen ist eine solche in 4 von den 40 Fällen HEUSSER's und in 24 von den 158 Fällen HEDBERG's vorgekommen. Der Unterschied dürfte sich aus der teilweisen Verschiedenartigkeit unseres Materials erklären.

*Der Palpatio**n**sbe**f**und* Wenn man die Aufmerksamkeit des L-ad m j-Patienten ablenkt, kann man beim Palpieren fast immer die vergrosserten Mesenterialdrüsen fühlen. Zu diesem Ergebnis gelangt man indessen nicht beim gewöhnlichen Palpieren, sondern man muss sich dabei der sog. Gleitpalpationstechnik bedienen. Indem die Darmschlingen allmählich ausweichen, beginnen dann die vergrosserten und verharteten Lymphdrüsen gegen die hintere Bauchwand fühlbar zu werden und gleiten einzeln unter den Fingerspitzen durch. Bei 91 Patienten konnten sie so vor der Operation ohne Narkose festgestellt werden. Ich wage jedoch zu behaupten, dass sie fast in 100 % fühlbar sind, wenn man nur daran denkt, den Bauch kindlicher Patienten auch mit Rücksicht auf diese Krankheit zu untersuchen. Das Palpationsergebnis kann zwar bisweilen bei unruhigen und aus Furcht spannenden Kindern sowie bei älteren Kindern wegen der Dicke der vorderen Bauchwand unsicher ausfallen. Auch in diesen Fällen gelangt man aber zum Ziel, wenn man in Narkose untersucht.

Die meisten Forscher auf dem Gebiet der L-ad m, u a ADAMS & OLNEY, BEROVICH & TRONGÉ und SENNELS behaupten, dass man die Drüsen nicht fühlen und die Krankheit nicht vor der Operation diagnostizieren kann. BOWMAN, FREEMAN, KLEIN, MARSHALL und WISE teilen mit, dass man sie bei mageren und ruhigen Kindern oft fühlt. Beim Untersuchen in Narkose fühlt man sie nach DE LA MARNIÈRE oft, aber nach MARSHALL immer. ROSENBERG ist der einzige, der sie stets zu fühlen behauptet.

*Spontane Schmerzen* werden von den Patienten laut Angabe oft in der Gegend des Mc Burney'schen Punktes, aber vielleicht noch häufiger ein wenig nach aufwärts und medial davon empfunden. Sehr häufig klagen insbesondere die kleinsten Patienten über Schmerzen in der Umgebung des Nabels. Viele von den sog. Nabelkoliken durften in der Tat — wie auch PRIBRAM bemerkt hat — Schmerzanfälle der L-ad m j sein. Das Wandern der Schmerzen nach der Mitte zu und sogar nach links, wenn sich der Patient beim Liegen auf die linke Seite dreht (KLEIN), was auf dem Dorthingleiten des Mesenteriums beruht, ist ein Symptom, das wohl eher mit den im Zusammenhang mit Darminfektionen auftretenden L-adenitiden als mit der hier in Frage stehenden Form in Verbindung steht.

Die lokale Empfindlichkeit lokalisiert sich deutlich auf die vergrösserten Drüsen vom Mc Burney'schen Punkt schrag nach links aufwärts und erstreckt sich in den älteren Fällen bisweilen quer über die Wirbelsäule, entspricht also der Lage der Radix mesenterii. Ein Entlastungsschmerz wurde nicht beobachtet, ein Umstand, den auch HEUSSER betont.

Erbrechen oder Übelkeit kam in 7 akuten, 4 chronischen und 23 rezidivierenden Fällen oder bei insgesamt 34 Patienten und in  $34 \pm 47\%$  vor.

HEUSSER und MARSHALL führen an, dass die meisten ihrer Patienten nicht erbrochen haben, in dem Material BROWN's wurde Erbrechen bei 8 von 30 und in demjenigen HEDBERG's bei 97 von 158 Patienten angetroffen.

Als Körpertemperatur ist in die Tabelle Nr. 4 die höchste vor der Operation gemessene axillare Temperatur eingetragen. Es scheint, als ob hohe Temperaturanstiege nicht einmal bei der akuten und rezidivierenden Form für die Krankheit charakteristisch seien. Von den chronischen Fällen haben nur 10 eine Temperatursteigerung gehabt, aber auch von ihnen keiner über  $37.8^{\circ}\text{C}$ .

Tabelle Nr. 4

## Die Körpertemperatur

Axill. Temperatur	Ak. Fälle	Rezid. Fälle	Chron. Fälle
T $\leq 36.9$	6	21	27
$37.0 - 37.5$	5	11	10
$37.6 - 38.5$	1	9	2
$38.6 - 39.5$	2	5	0
$39.6 \leq T$	0	1	0

Von den übrigen Forschern begnügt sich MARSHALL mit der Bemerkung, dass das Fieber höher als bei Appendizitis ist, und HEDBERG, dass die Temperatur bei 80 Patienten  $38.0^{\circ}\text{C}$  überstieg. Von den Patienten HEUSSER's hatten fast 50% Temperaturen über  $37^{\circ}\text{C}$  gehabt und  $1/10$  Temperaturen von  $37.5 - 38.0^{\circ}\text{C}$ .

Eine Durchleuchtung der Lungen nahm ich, weil die Krankheit so oft als tuberkulos angesprochen wird (s. S. 251), bei allen meinen Patienten vor. Nur bei einem waren die Hilusschatten in der Masse vergrössert, dass man es auf eine tuberkulöse Hilusadenitis hatte zurückführen können, aber die Pirquet-Reaktion fiel negativ aus. Herdschatten, Narben oder Pleuritisspuren wurden bei keinem Patienten festgestellt.

Eine ähnliche systematische Untersuchung hat nur HEUSSER und zwar mit demselben negativen Ergebnis ausgeführt STROMBACK hat das Abdomen seiner Patienten röntgenphotographiert und auf den Bildern auch in nicht-tuberkulösen Fällen deutliche Drusenschatten gesehen. Eine entsprechende Untersuchung habe ich in Ermangelung einer für den Zweck geeigneten Röntgenapparatur nicht ausführen können.

Die *Pirquet-Reaktion* war in  $22 \pm 4,2\%$  positiv. Vergleichshalber sei erwähnt, dass von den 1,535 in den Jahren 1940—42 kontrollierten Volksschulern der drei nächsten Nachbargemeinden, deren mittleres Alter ungefähr das gleiche wie in meinem Material war,  $24,3 \pm 1,1\%$  tuberkulipositiv waren.

HEDBERG's Patienten waren sämtlich Pirquet-negativ, ebenso von den Patienten IRELAND's alle und von den Patienten SENNEL's die meisten in dieser Beziehung untersucht.

*Tuberkulose Lymphome* oder als solche verdächtige Drusenschwellungen am Hals sind in meinem Material nicht vorgekommen. Ganz kleine harte Lymphdrüsen wurden dagegen am Hals oder Nacken von 27 Kindern palpiert. Die Pirquet-Reaktion war nur bei 4 derselben oder in  $15 \pm 6,9\%$  positiv. 14 von diesen Kindern hatten kariöse Zähne, ausserdem noch 25 andere Kinder.

Eine *Hypertrophie der Rachen- oder Gaumentonsillen* lag in insgesamt 7 Fällen vor. HEUSSER gibt an, dass die Tonsillen mehrmals vergrössert waren. Symptome einer akuten Tonsillitis habe ich keinmal angetroffen.

*Darmschmarotzer oder deren Eier* wurden bei zusammen 17 Patienten entweder in den Stuhlproben, bei der Operation oder in den mikroskopischen Präparaten der Appendix festgestellt. Hierbei handelte es sich einmal um *Dibotriocephalus latus*, 7mal um *Ascaris*, 8mal um *Oxyuris* und einmal um *Ascaris* + *Oxyuris*. Die Frequenz durfte kaum grosser sein als bei den Kindern der Gegend im allgemeinen. Über die *Urinuntersuchungen* ist nichts weiter zu erwähnen, als dass ein Patient, in dessen Anamnese eine Nephritis ac. vorkam, die für diese Krankheit typischen pathologischen Symptome darbot. Die Angabe McFADDENS, dass nach den Anfällen mehrere Tage lang Azeton im Urin auftrate, habe ich nicht kontrollieren können, weil ich seine Abhandlung erst nach der Einsammlung meines Materials gelesen habe. Ich mache jedoch darauf aufmerksam, dass sein Material tuberkulös war. Das *Probefrühstück* wurde nur bei 4 Patienten sowie ausserdem im Zusammenhang mit der Nachuntersuchung bei 5 Patien-

ten untersucht, die noch Monate nach der Appendektomie über Leibschmerzen klagten. Von den letzterwähnten erwiesen sich 4 als achylisch, während bei einem eine erhebliche Hyperazidität bestand.

Weil nach den von P. FORSSELL an Helsinkier Schulkindern ausgeführten Untersuchungen Sekretionsanomalien sehr gewöhnliche Ursachen für chronische Leibschmerzen bei Kindern darstellen, wäre es des Vergleichs halber interessant gewesen, die Magensekretion gerade bei chronischen L- und j-Kranken zu untersuchen. Leider wurde aber das Probefuhrstück nicht unter die systematischen Untersuchungen aufgenommen, da mir die Abhandlung FORSELL's erst beim Verfassen der vorliegenden Arbeit bekannt wurde.

Die *Senkungsgeschwindigkeit der roten Blutkörperchen* (SR) ist nach der Westergren'schen Methode bestimmt worden. In allen 3 Gruppen wurden sowohl normale als auch hohe pathologische Werte durcheinander erhalten. Inbezug auf die Gruppen kann man keine andere Folgerichtigkeit bemerken, als dass in der Gruppe der akuten Fälle die meisten und die höchsten pathologischen Werte, in der Gruppe der chronischen wiederum die meisten normalen und die relativ niedrigsten pathologischen Werte vorkommen. Auch zwischen der Höhe des Temperaturanstiegs und der SR scheint kein deutliches Abhängigkeitsverhältnis zu bestehen, zwar wurden die höchsten Werte bei den am höchsten fiebernden Patienten in der Gruppe der akuten Fälle angetroffen, aber recht hohe Werte (auch der höchste des Materials!) kamen sowohl in dieser als auch in den beiden anderen Gruppen bei ganz fieberfreien Patienten vor, sowie umgekehrt niedrige und ganz normale Werte bei hochfiebernden. Bei den Pirquet-positiven Patienten wurden ebenfalls durcheinander sowohl hohe als auch niedrige Werte beobachtet.

Das Verhalten der Leukozytose (L) war in grossen Zügen analog. Am meisten Zellen wurden im allgemeinen in fiebernden und akuten Fällen gefunden. Beinahe ebenso hohe Zahlen kamen jedoch reichlich in der Gruppe der rezidivierenden und einige sogar in der Gruppe der chronischen Fälle vor. Normale Zahlen wurden in allen Gruppen, am meisten natürlich bei den chronischen Fällen festgestellt. SR und L stimmten nur da, wo es sich um die höchsten Werte handelte, überein, in den anderen Fällen konnten sie ganz auseinandergehen.

Auch in der *Zusammensetzung des weissen Blutbildes* war kei-

nerlei Gesetzmässigkeit wahrzunehmen Beim ersten Überblick scheint es, als wäre etwa der Hälfte der in dieser Beziehung untersuchten Patienten eine Lymphozytose und bei etwa einem Funftel umgekehrt eine Lymphopenie vorgekommen Die Sache verändert sich aber, wenn man das Alter der jungen Patienten und dessen Einfluss auf das weisse Blutbild berücksichtigt Die Anzahl der Lymphozytosefälle sinkt auf 10 ( $12 \pm 3.6\%$ ), während viele anscheinend normale Werte bei den jüngsten Patienten eigentlich als relativ lymphopenisch anzusprechen waren Eine Linksverschiebung ist in den Gruppen der akuten und rezidivierenden Fälle ungefähr bei der Hälfte, in der Gruppe der chronischen dagegen nur bei etwa einem Drittel der Patienten zu beobachten Eine Eosinophilie ist unter den spärlichen akuten Fällen gar nicht, unter den rezidivierenden bei 2 (8 %) und unter den chronischen bei 10, also etwa bei einem Drittel aller Patienten der Gruppe, vorgekommen Bei einem derselben machten die Eosinophilen volle 20 %, bei den übrigen 9 höchstens 9 % aus Etwas auf eine Allergie hindeutendes in der Anamnese dieser Patienten war indessen nicht festzustellen Sonstige Zellformen kamen nicht in starker pathologischen Mengen vor Zwischen dem weissen Blutbild einerseits und der Tuberkulinpositivität, der Höhe der SR und der Körpertemperatur andererseits schien kein konsequentes Abhängigkeitsverhältnis zu herrschen

Die Literaturangaben über das weisse Blutbild sind recht spärlich HEUSSER und SENNELS begnügen sich mit der Feststellung, dass keine Verschiebung wahrzunehmen sei Die Anzahl der Leukozyten hat bei 64 von den 126 Fällen HEDBERG's und bei 17 von den 22 Fällen IRELANDS' 10,000 überstiegen BROWN erwähnt, dass sie sich im allgemeinen um ca 20,000 bewege Eine Eosinophilie hatte er bei 3 Patienten angetroffen (9, 10 und 17 %) Von den durch die differentialdiagnostisch in Frage kommende Appendizitis im Blutbild hervorgerufenen Veränderungen führt BISPING an, es werde hierbei eine desto stärkere Leukozytose und Lymphopenie sowie Linksverschiebung angetroffen, je schwerer der Fall sei

*Das rote Blutbild* Trotzdem die meisten Patienten anamisch blass aussahen, hatte doch keiner von ihnen einen niedrigeren Hamoglobinwert als 80 % (SAHLI) Die Erythrozytenzahl schwankte zwischen 3,260,000 und 5,290,000, anscheinend wenigstens in teilweiser Abhängigkeit von Alter und Geschlecht Eine Poikilo- und Anisozytose kamen nicht vor Der Index schwankte zwischen 0.90 und 1.28, hielt sich jedoch bei dem grossten Teil der Fälle dicht über und unter 1.00 und überstieg nur in 10 Fällen 1.10.

Die WASSERMANN-, KAHN- und andere Luesreaktionen wurden bei meinen Patienten nicht untersucht. Meines Erachtens lag keine Veranlassung zu deren Anstellung vor, weil die Krankheit, bei der sich die vergrösserten Drüsen nur auf das Gebiet des Mesenteriums beschränkten, kaumluetischen Ursprungs sein konnte. Auch die FREY'sche Reaktion ist keinmal angestellt worden, weil das Lymphogianuloma inguinale bei so jungen Patienten etiologisch nicht in Frage kommen kann. IRELAND hat die Reaktion 12mal mit negativem Ergebnis angestellt. Die Mononucleosis infectiosa wiederum ist in Finnland so selten und ausserdem ihrem Krankheitsbild nach so andersartig, dass die Aufnahme der PAUL-BUNNEL-Reaktion in das Arbeitsprogramm als überflüssig betrachtet wurde. Die BANG- und die WIDAL-Reaktion wurden bei den 2 Patienten ausgeführt, bei denen das Fieber nicht gleich nach der Operation aufhorte, und war bei beiden negativ. Dagegen war sie positiv (1/500) in einem aus dem Material fortgelassenen Fall, wo der ganze Darm gerötet und geschwollen und die Drüsen von dem undurchsichtigen, stark injizierten Peritoneum verdeckt waren. Der Fall erwies sich dann klinisch auch als Paratyphus.

### Diagnose

Bei den akuten L-ad m j -Fallen muss die Differentialdiagnose in erster Linie in bezug auf Appendizitis und einige akute Darminfektionen, wie z. B. Paratyphus, gestellt werden. Bei den chronischen und rezidivierenden Fällen wiederum kommen Appendizitis und die tuberkulösen Mesenteriallymphome, die sog. Nabelkoliken sowie die von Sekretions- und Lageanomalien des Magens herrührenden Beschwerden in Frage. Die letzterwähnten kann man durch die Probefrühstück- und Röntgenuntersuchung ausschliessen. Dagegen gibt es zur Feststellung der L-ad m j keine lediglich für diese Krankheit pathognomonischen, klinischen oder durch Laboratoriumversuche nachweisbaren Symptome. Der Untersuchende muss seine Zuflucht im allgemeinen, und zumal was die Differentialdiagnose gegenüber Appendizitis betrifft, ausschliesslich zu einer genauen Anamnese und seinen eigenen Fingern nehmen. Trotzdem ist es für einen mit der Krankheit Vertrauten meines Erachtens möglich, die Diagnose in fast 100 % schon vor der Operation zu stellen. Nur in einigen sehr akuten Fällen kann die Ausschliessung der Appendizitis unsicher bleiben. Zwar behaupten HEDBERG, LAWEN, SENNELS und SPEESE, dass die Diagno-

stellung vor der Operation unmöglich und sogar gefährlich sei (HEDBERG), aber wenn man bei Appendizitis und bei L ad m j systematisch genau dieselbe operative Behandlung zur Anwendung bringt (s S 251) so ist es ganz gleichgültig, ob die Differentialdiagnose zwischen den 2 Krankheiten richtig oder falsch ist. Beim Verwenden einer konservativen Behandlung dagegen kann ein Irrtum sehr verhängnisvoll werden.

In meinem vorliegenden Material habe ich die richtige Diagnose in 97 Fällen oder  $97 \pm 17\%$  vor der Operation gestellt. Bei 91 Patienten habe ich die Drüsen palpiert, aber in 6 Fällen hat sich die Diagnose hauptsächlich auf die typische Anamnese gegründet, weil es mir nicht gelang, die Lymphdrüsen sicher zu palpieren. Drei Patienten habe ich als Appendizitiden operiert. Die Ärzte in der Umgebung haben nur einen Fall unter der richtigen Diagnose, die anderen sämtlich als Appendizitiden eingewiesen.

### Der Operationsbefund.

Wenn die Bauchhöhle eines L-ad m j -Patienten eröffnet wird, fließt aus der Wunde gewöhnlich eine klare, geruchlose Flüssigkeit aus, oder die Därme sind wenigstens feucht-glanzend. Im vorliegenden Material fehlte dies Symptom der peritonealen Reizung nur bei einem Patienten in der Gruppe der akuten, bei 6 in der Gruppe der rezidivierenden und bei 4 in der Gruppe der chronischen Fälle. Die schon in der Einleitung erwähnten knorpelfarbigem, durch das Peritoneum klar durchschimmernden, vergrößerten und verharteten, voneinander getrennten Lymphdrüsen ohne Periadentis wurden bei allen Patienten im Mesenterium angetroffen, bei einigen nur im Ileocoecalwinkel, aber bei den meisten längs des ganzen Mesenteriums, bei einigen sogar auf dem Coecum und, selten, auch im Mesenteriolum. Die größten Drüsen waren im allgemeinen bohnergross, aber in einem zweimal operierten Fall ca 3 cm lang, bohnenförmig. Eine schwache Kapillareninjektion war an den Drüsen von 22 Patienten bemerkbar. Abszessbildungen, käsige Nekrosen oder Verkalkungen wurden kein einziges Mal angetroffen.

Das *Coecum* war bei 76 Patienten weiter, freier und beweglicher als normal. SWAIM hat offenbar dieselbe Beobachtung gemacht, da er eine Stase im Coecum als Ursache der Krankheit betrachtet. Bei meinen eigenen Patienten ist eine solche indessen nicht wahrzunehmen gewesen. Das *Ileum* war bei allen gesund, in einigen

Fallen sehr dünnwandig, so dass die Peyer'schen Plaques durchschimmerten. Bei 4 von den 26 Patienten BROWN's und bei 20 von den 158 Patienten HEDBERG's lag eine Injektion oder ein leichtes Odem in den Terminalabschnitten des Dunndarms vor. Im Endteil des *Mesenteriums* fand sich bei 6 Patienten an der unteren Seite ein entweder angeborenes oder wahrscheinlicher durch Vernarbung entstandenes Gebilde, das das Ileum einermassen nach hinten abschnürte. Ungewiss bleibt, ob es die Folge der L-ad m j oder, was plausibler erscheint, die Folge einer ausgeheilten Entzündung des Darms oder des Mesenteriums war. Wenigstens im Bereich der Lymphdrüsen waren auch in diesen Fällen keine Narben wahrzunehmen. Nach BRUNING sind derartige Gebilde durch eine Lymphangitis mesenterialis verursacht. Wie an der Appendix und im Zusammenhang mit ihr aufgrund der äusseren Inspektion beobachteten, möglicherweise pathologischen und vielleicht ätiologisch in Frage kommenden Umstände sind in der Tabelle Nr. 5 verzeichnet. Eine auf akute Entzündung

Tabelle Nr. 5.

*Die makroskopischen Veränderungen des Appendix*

		Adherent (z. T. injiziert), wahrscheinlich		Injiziert (z. T. adherent)
		kongenital	als Folge einer Entzündung	
Ak	Fälle	0	2	5
Rezid	»	4	4	4
Chron	»	5	3	3
Insgesamt		9	9	12

hinweisende diffuse Rotung und ein Odem wurden kein einziges Mal angetroffen, wohl aber in 12 Fällen einige ungewöhnlich starke und blutreiche Gefässe, häufig ist auch die Appendixwand gleichzeitig dicker und heller als in der Norm erschienen. Die Appendix ist in 18 Fällen adherent gewesen, aber nur in 9 Fällen hat es den Anschein gehabt, als könnte dies die Folge einer früheren Entzündung sein. In den übrigen Fällen haben die adherierenden Peritonealmembranen einen kongenitalen Eindruck gemacht, und als kongenital werden sie heute aufgrund der bei Föten und kleinen Kindern ausgeführten Untersuchungen im allgemeinen auch betrachtet, desgleichen auch die kurzen, geschlangelten Mesenteriole.

## Mikroskopische Untersuchungen.

*Appendix* Das Ziehen einer Grenze zwischen dem Normalen und Pathologischen in bezug auf die Struktur der Schleimhaut und des Lymphgewebes an der Appendix ist ausserordentlich schwer und subjektiv. Die normale Anatomie des Wurmfortsatzes schwankt ja, auch aufgrund des Alters, ganz enorm. Nach den Untersuchungen BERNARDO-COMEL's vermehren sich die Lymphfollikel bis zum 13—17 Lebensjahr, um dann von der Spitze her allmählich abzunehmen. Da sich von den Follikeln fortwährend Lympho- und Leukozyten ablosen, kann die Epitheldecke im Bereich der Follikel zeit- und stellenweise fehlen und können im Appendixlumen so viel Zellen angesammelt sein, dass es Eiter zu enthalten scheint. Diese Erscheinung war auch in meinem eigenen Material recht oft zu beobachten, weil aber gleichzeitig kein entzündliches Odem und keine Leukozyteninfiltration in der Wand nachzuweisen waren, habe ich sie nicht als pathologisch angesprochen. Dagegen lag bei 3 Patienten in einem kleinen Bezirk eine begrenzte Pigmentation nach einer geheilten Infiltration und beim einen eine kleine, sich durch alle Wandschichten erstreckende Narbe als Zeichen einer alten verheilten Perforation vor. Bei denjenigen wiederum, bei denen die früher erwähnten erweiterten oberflächlichen Blutgefässe angetroffen wurden, waren sonst keine Entzündungssymptome nachzuweisen. Eine floride akute oder chronische Appendizitis kam also bei keinem einzigen Patienten vor, wohl aber bei einem eine frische Schleimhauttuberkulose mit zahlreichen Tuberkeln.

Von den früheren Forschern teilt BROWN mit, er habe bei 50 % seiner Patienten die Appendix leicht gerötet gefunden. In 8 von den 19 histologisch untersuchten Fällen IRELAND's bestand »any evidence of pathologic change«. MARSHALL schreibt »General no gross appendicular disease«, HEDBERG »I 4 fall har man funnit tecken till inflammation i appendix« (»in 4 Fällen wurden Anzeichen einer Appendizitis gefunden«) und HEUSSER »manchmal mehr oder weniger ausgedehnte Obliterationen des Lumens, stellenweise vorhandene narbige Veränderungen einzelner Wandschichten und oftters auch Entwicklung von Fettgewebe in der Submucosa. Die Schleimhaut war oft intakt, oft, so beim Verschluss des Lumens, ganz zerstört. Hier und da fand man auch Schleimhautlasionen und Bilder, die den von RHEINDORF beschriebenen Befunden ähnlich sahen. Die verschiedenen Wandschichten der Appendix wiesen ausserdem oftters geringgradige lymphocytare Infiltration auf«.

Die von HRUSSER erwähnte Bildung von Fettgewebe in der Submukosa kam auch in einem Fall des vorliegenden Materials vor. Sechsmal fand ich Oxyuren im Appendixlumen, aber keinmal in die Schleimhaut eingegraben wie HEUSSER. Askarideneier wurden einmal im Wurmfortsatz angetroffen.

*Die Lymphdrüsen.* In akuten Fällen war ein mächtiges Ödem das augenfälligste und in einigen sogar das einzige pathologische Symptom. Meistens waren jedoch ausserdem ein Sinuskatarrh sowie eine Retikulum- und Bindegewebswucherung zu beobachten. Der letzterwähnte Befund scheint zu der kurzen Anamnese im Widerspruch zu stehen. Er kann indessen wohl zum Teil auf gleich gerichtete, mit dem Alter kommende Veränderungen von wechselnder Stärke zurückzuführen sein. Möglicherweise kann er aber auch bedeuten, dass diese Fälle gar nicht so frisch waren, wie es die Anamnese auswies, sondern dass die Krankheit auch bei diesen Patienten schon längere Zeit, wenn auch ohne nennenswerte subjektive Symptome, gedauert hatte.

In der Gruppe der rezidivierenden Fälle lag regelmässig ein leichtere oder schwerer Sinuskatarrh vor, desgleichen eine Wucherung des Retikulums und des Bindegewebes. Die Schwankung in der Stärke der Veränderungen schien, ausser von der Dauer der Krankheit, auch, obschon nicht ganz konsequent, von dem Alter der Patienten abzuhängen. Abgesehen von wenigen Ausnahmen schien die Bindegewebswucherung von der Kapsel, die des Retikulums wiederum vom Mark her zu beginnen. Das Ödem konnte auch in Fällen von langer Dauer sowie in verschiedenen Drüsen eines und desselben Patienten verschieden stark sein. Diejenigen, die infolge einer Peritonealreizung am meisten Flüssigkeit in der Bauchhöhle hatten, boten auch am meisten Ödem in ihren Drüsen dar.

Tuberkulöse Veränderungen habe ich in keinem einzigen Präparat angetroffen, nicht einmal bei dem Patienten, der eine Appendixtuberkulose hatte. Die 17 Fälle, bei denen aus der Drüsenkultur Bakterien wuchsen, boten kein von den anderen irgendwie abweichendes histologisches Bild.

Es liegen also keine für die L-ad m j allein charakteristischen Veränderungen in der Struktur der Lymphdrüsen vor. Es handelt sich lediglich um einen Sinuskatarrh und eine einfache Hyperplasie. Nekrosen, Abszesse und Verkalkungen fehlen im histologischen Bild vollständig. Auch die Bindegewebshypertrophie ist im allgemeinen recht massig, ein auffälliger Schwund, von

Lymphgewebe kam nicht vor, und auch in den allerlangwierigsten Fällen durften sich die Drüsen niemals in Narbenmassen umwandeln. Die Follikel sind in der Regel wohl erhalten und enthalten gewöhnlich kraftige Keimzentren, auch sekundäre Follikel werden oft beobachtet. Die Frequenz der Veränderungen ist in der Tabelle Nr. 6 dargestellt.

Tabelle Nr. 6

*Die mikroskopische Anatomie der Lymphknoten*

	Ak. Fälle	Rezid. Fälle	Chron. Fälle
Ödem	5	2	0
Ödem und Retikulozytose	0	3	1
Ödem und Bindegewebswucherung	1	3	1
Ödem, Retikulozytose und Bindegewebswucherung	4	24	25
Bindegewebswucherung	0	1	1
Retikulozytose und Bindegewebswucherung	4	8	9
Blutungen (ausser den vorigen)	2	13	7

Von den früheren Forschern auf dem Gebiet dieser Krankheit haben nur HEUSSER und MARSHALL Lymphdrüsen in nennenswertem Umfang mikroskopisch untersucht. Beide haben eine blosse entzündliche oder chronische einfache Hyperplasie ohne Bindegewebswucherung oder -schrumpfung festgestellt.

### Bakteriologische Untersuchungen.

Aus den Drüsenproben wuchsen bei der Kultur

*Bacterium coli commune* in 14 Fällen

*Enterococcus* » 1 Fall

*Bacillus acidilactici* » 1 »

Ein nicht genauer bestimmter, Gram-positiver Kokkus in 1 Fall. Die übrigen 48 Fälle waren steril. Alle 62 Lowensteinkulturen und 32 Meerschweinchenversuche fielen negativ aus.

In den 25 Kulturen HEUSSER's und den 48 Kulturen MARSHALL's sind je 2mal Colibazillen gewachsen. IRELAND hat einmal *Streptococcus haemolyticus* festgestellt. Die Lowensteinkulturen und Meerschweinchenversuche der erwähnten Forscher ebenso wie diejenigen BROWN's lieferten negative Ergebnisse. Von SENNEL'S 9 Meerschweinchen war 1 gestorben, in dem aber auch histologisch keine Tuberkulose nachgewiesen werden konnte. Die Resultate von gemischten Fällen umfassen-

dem Material sind sehr bunt gewesen, einige, / B GAGE, behaupten, in allen von ihnen untersuchten Lymphdrüsen Bakterien, vorwiegend Enterokokken, gefunden zu haben, andere wiederum, wie ROSENBERG, WISE usw., teilen mit, dass ihre Kulturen stets steril geblieben seien. Zwischen den Vertretern dieser Extreme gibt es eine Anzahl Forscher, die aus einem Teil ihres Materials Coli, pyogene Bakterien, hämolytische Streptokokken usw. gezüchtet haben (z. B. ADAMS & OLNEY, BEROVICH & TRONGL, KLIBER, v. SASSLIN u. a.). Der letzterwähnte hat darauf aufmerksam gemacht, dass die Ergebnisse häufiger positiv sein könnten, wenn die Kultur immer von einer grossen Menge Drüsen angelegt würde. Wegen der geringen Zahl der Proben misst HEDBERG auch den Löwensteinkulturen und den Meerschweinchenversuchen keinen allzu grossen Wert bei. Meines Erachtens müssen dieselben jedoch als beweisend gelten, denn man kann wohl nicht annehmen, dass, wenn irgendeine Lymphdrüse von Tuberkulose angegriffen wäre, auch ihre gesunden Nachbardrüsen sich vergrösserten, und dass zufällig alle Proben von solchen aus »Sympathie« vergrösserten Drüsen entnommen waren.

### Die Behandlung und deren Resultate

Wie aus dem oben Dargestellten schon hervorgehen dürfte, bestand die Behandlung in der in Äther- oder Äthernarkose ausgeführten Appendektomie. Ausserdem wurden die Darmschmarotzer, wo solche vorhanden waren, abgetrieben. Anderweitige therapeutische Massnahmen kamen nicht zur Anwendung.

Das *primäre Ergebnis* war, abgesehen von 2 Fällen, über die weiter unten genauer berichtet wird, stets gut. Die Schmerzen hörten auf, und in den fieberhaften Fällen kehrte die Körpertemperatur gleich nach der Operation zur Norm zurück. Die Patienten wurden im allgemeinen am 5. oder 6. Tage nach der Operation aus dem Krankenhaus entlassen. Die durchschnittliche Dauer des Krankenhausaufenthalts beträgt jedoch 7 Tage. Die Verlängerung beruhte auf 11 postoperativ eingetretenen Pneumonien, die jedoch sämtlich unter Sulfonamidmedikation bald genasen, sowie auf einer bei 6 Patienten vorgekommenen leichten Eiterung (im subkutanen Fettgewebe) der Operationswunde, die stets in kürzerer Zeit als 14 Tagen behoben wurde. Verlängernd auf den Krankenhausaufenthalt wirkte auch der Umstand ein, dass die Operation im allgemeinen nicht am Aufnahmetage stattfand, sondern wegen der Blutuntersuchungen gewöhnlich auf den folgenden Tag verschoben wurde.

Zur Ermittlung des *Spätergebnisses* liess ich meine Patienten zur Nachuntersuchung kommen, die frühestens 1 Monat nach der

Entlassung vorgenommen wurde 30 Patienten kamen der Aufforderung nach Nach dem Befinden der restlichen 70 habe ich mich schriftlich erkundigt und von 66 die erbetenen Angaben erhalten Die Ergebnisse sind in der Tabelle Nr 7 zusammen-

Tabelle Nr 7.

*Die Heilungsergebnisse*

Geheilt unmittelbar nach der Operation	79	
» 2—8 Wochen » » »	8	
» 10 Monate » » »	1	
» nach Relaparotomie	1	
Fortdauernde Beschwerden	7 infolge von	<div style="display: inline-block; vertical-align: middle;">                     Sekretionsanomalien 4                      Interposition colonis transversi 11                      ungeklärten Ursachen 2                 </div>
Endgültiges Heilungsergebnis unbekannt	4	
Zusammen 100		

gestellt Wenn also noch Beschwerden nach der Operation bestanden haben, so sind sie in der Regel innerhalb von  $\frac{1}{2}$ —2 Monaten verschwunden Nur 8 Patienten klagten über fortgesetzte Beschwerden, die aber ihrer Beschaffenheit nach wenigstens bei einem Teil der Patienten auf Sekretionsanomalien des Magens hingen Deswegen liess ich sie zur Untersuchung kommen und konstatierte aufgrund des Probefrühstücks bei 3 von ihnen so subazide Werte, dass die Beschwerden offenbar davon herrührten Ein Patient war in Militärdienst eingetreten und wurde auf meinen Wunsch bei der Truppe untersucht, weil er sich nicht bei mir einfinden konnte Bei ihm wurde eine stark superazide Gastritis festgestellt Die Ursache der Beschwerden eines Patienten bestand in einer Interpositio colonis transversi Die kolikartigen Beschwerden zweier Patienten blieben ungeklärt Bei einem 5jährigen kleinen Mädchen bestanden tagliche, in der Nabelgegend und nach rechts davon empfundene Schmerzen sowie eine Temperatursteigerung auf  $38^{\circ}$  Die persönliche Nachuntersuchung verschob sich infolge meiner Abkommandierung, aber die Beschwerden der Patientin horten nach Verlauf von 10 Monaten allmählich auf, und sie ist seit dem gesund geblieben In dem vorliegenden Material ist noch ein zweiter ähnlicher Fall vorhanden Ein Unterschied bestand jedoch insofern, als die Temperatursteigerung und die Beschwerden, die allmählich nach dem Epigastrium und dem linken Hypochondrium gewandert waren, 14 Monate nach der Appendektomie den Anlass zu einer neuen Operation gaben Bei der im Gedanken an Gallensteine ausge-

fuhrten Probelaaparatomie stellte ich als einzige mögliche Verursacher der Beschwerden einige in der Radix mesenterii gelegene ca 2 5—3 cm lange, 2 cm breite und ca 1 cm dicke Lymphdrüsen fest, von denen die zwei obersten auf die Flexura duodenojejunalis drückten und eine Verengung derselben hervorriefen. Die während der ersten Operation konstatierten peripheren Drüsen-schwellungen waren geheilt, ohne irgendwelche Narben zu hinterlassen. Die erwähnten grossen, obturierenden Drüsen wurden exstirpiert. Die Schmerzen horten danach sofort auf, ebenso die Temperatursteigerung, die insgesamt 19 Monate gedauert hatte.

Von den sonstigen späteren Schicksalen meiner Patienten sei in diesem Zusammenhang erwähnt, dass die 2 ältesten 2—3 Jahre nach der durch L-ad m j veranlassten Appendektomie an Lungentuberkulose erkrankten. Die Pirquet-Reaktion und die Röntgenuntersuchung der Lungen waren damals negativ gewesen, so dass die Ansteckung später stattgefunden haben dürfte.

Von den früheren Forschern befürworten HEDBERG und MARSHALL in sicheren Fällen eine konservative Behandlung aber in unsicheren zur Vermeidung verhängnisvoller Irrtümer die Laparotomie unter gleichzeitiger Entfernung der Appendix. Aus dem letzterwähnten Grunde operieren auch LAWEN, SENNELLS und IRELAND und exstirpieren die Appendix, wenn sich nicht anderswo eine Ursache für die Vergrösserung der Drüsen findet. BROWN verfährt ebenso, weil er bemerkt hat, dass die Krankheit auf diese Weise am besten geheilt wird. HEUSER entfernt gleichzeitig die grössten Lymphdrüsen. Von den Forschern mit einem mehr gemischten Material sei erwähnt, dass mehrere, z. B. BOWMAN, FREEMAN, KLEIN, PARINI und STROMBECK in sicheren Fällen eine konservative Therapie (Vitamine, Wurm-kuren, Helio- und Röntgentherapie usw.) befürworten, aber in unsicheren die Probelaaparotomie ausführen. Die letzterwähnte immer auszuführen halten wenigstens BELL, BOSHAMER, GAGE, DE LA MARNIERE und SCHRAGER für ratsam. Von den Anhängern der operativen Behandlung seien ferner genannt ADAMS & OLNEY, FOSTER jr, KLEIBER, PRIBRAM, ROSENBERG, SPEESE & KLEIN und WISE, die sämtlich die Appendektomie vornehmen. HERTEL, McFADDEN und NOESSKE halten es für am klugsten, gleichzeitig die grössten Lymphdrüsen mit fortzunehmen. KLEIBER und PRIBRAM empfehlen die Tonsillektomie sowohl als prophylaktische als auch therapeutische Massnahme, weil sie glauben, dass die Tonsillen die Eingangspforte bilden, durch die der Krankheitserreger in den Körper gelangt.

Nachuntersuchungen scheinen sehr wenige ausgeführt zu haben. GÜLEKE, HEDBERG und LAWEN durften darauf verzichten haben. HEUSER und SENNELLS geben an, dass 42 bzw 73 % ihrer Patienten symptomfrei und 16 5 bzw 9 % gebessert wurden, während die Beschwerden bei 41 5 bzw 18 % noch jahrelang unverändert fortgedauert ha-

ben IRELAND hat in 4 von 20 und MARSHALL in 4 von 28 Fällen noch im Verlauf von 1 Monat bis 2 Jahren postoperative Attacken beobachtet. Dagegen haben die innermedizinisch behandelten Fälle MARSHALL's 6 Monate bis 5 Jahre zu ihrer Heilung beansprucht. BROWN erwähnt nur kurz, dass bei der konservativen Behandlung Rezidive vorkommen, bei der operativen aber nicht. Von den 40 operierten Patienten STROMBECK's waren 33 symptomfrei geblieben, von den 8 Patienten WISE's 7, aber von den 29 ROSENBERG's nur 10. KLEIN berichtet über 50 Nachuntersuchungen, von denen 20 operiert waren, dass »ein Teil« leichte Anfälle gehabt hatte.

Die Heilungsergebnisse in meinem eigenen Material —  $82 \pm 3$  % sogleich und  $8 \pm 2$  % binnen einiger Wochen symptomfrei Geheilte — sind also besser als in irgendeinem andern Material, was vermutlich auf der Verschiedenheit des Materials beruht. Aufgrund derselben, und weil die lange Anamnese der meisten Patienten bewies, dass eine konservative Behandlung (die Röntgentherapie war freilich in keinem Fall versucht worden) ergebnislos blieb, halte ich die Appendektomie wenigstens für die juvenile Art der mesenterialen Lymphadenitiden für die beste Therapie, obwohl in der Appendix keine verständliche Ursache für die Krankheit gefunden wird. Es ist auch motiviert, die größten Drüsen zu entfernen, nämlich dann, wenn man aufgrund ihrer Lage annehmen kann, dass sie später Störungen in der Funktion des Darmes oder anderer Organe der Bauchhöhle veranlassen können.

### Über die Ätiologie.

Über die Ätiologie der Lymphadenitis mesenterialis sind die verschiedensten Ansichten vorgebracht worden. Dies ist auch natürlich, weil es sich nicht um ein einheitliches »Krankheitsindividuum« sondern um eine ganze Gruppe ähnlicher und unter demselben Namen vereinigter Krankheitszustände handelt. Viele Forscher, z. B. BELL, BRAITHWAITE, McFADDEN, CLUTE, DE LA MARNIÈRE und STRUTHERS halten an der Auffassung fest, dass die Krankheit auch in den Fällen, wo man keine für Tuberkulose charakteristischen Gewebeveränderungen nachweisen kann, tuberkulös ist. BEROVICH & TRONGÉ, HERTEL, SCHRAGER und PRIBRAM machen die Tonsillen dafür verantwortlich. Hiergegen wendet ROSENBERG ein, dass bei 23 von seinen 75 L-adj-Patienten die Tonsillen schon früher entfernt worden waren, auch 17 von den 48 Patienten MARSHALL's hatten keine Tonsillen mehr. ADAMS & OLNEY, BRENNEMANN, PLAAS und STROMBECK halten Katarrhe der Luftwege für die primären Erkrankungen. WISE

wiederum erklärt das Nacheinanderauftreten der beiden Krankheiten als einen blossen Zufall, weil die Patienten Kinder sind, bei denen die erwähnten Katarrhe sehr oft vorkommen. BEROVICH & TRONGÉ, FREEMAN, HEDBERG, PLAAS und STROMBECK nehmen an, dass der Krankheit Entzündungen des Ileums und Coecums zugrundeliegen, BROWN, IRELAND, MARSHALL, MAYO, PLAAS und v. SASSEN suchen die Ursache in Erkrankungen des Wurmfortsatzes. BEROVICH & TRONGÉ, DRACHTER, GAGE, GULEKE und HEUSSER sprechen die Darmschmarotzer als beachtenswerte ätiologische Faktoren an, HEUSSER sogar als die wichtigsten. Gegen seine Auffassung wendet SENNELS ein, dass sich die Sache wohl nicht so verhalten könne, weil die Wurmpatienten im allgemeinen keine vergrosserten Mesenteriallymphdrüsen haben. Ich für mein Teil möchte noch hinzufügen, dass Darmschmarotzer bei den Patienten meines Materials nicht öfter vorkamen als bei den gleichaltrigen Kindern der Gegend im allgemeinen. KLEIN und WISE vermuten, dass die Krankheit durch irgendein Virus verursacht ist. WHITE & COLLINS führen ausdrücklich das Poliomyelitisvirus an. WISE macht demgegenüber geltend, dass die L-Ad im Gegensatz zur Poliomyelitis eine chronische, periodische Krankheit ist. LEWIS möchte die Krankheit der Febris undulans gleichstellen, aber IRELAND polemisiert dagegen aufgrund der Verschiedenheit des weissen Blutbildes und der Negativität der von ihm angelegten Bakterienkulturen. Negativ fielen auch die Bang-Reaktionen in den 2 Fällen meines Materials aus, in denen das Fieber nach der Appendektomie noch monatelang fort dauerte und hierdurch eine Übereinstimmung mit dem Krankheitsbild der Febris undulans hervorrief. Viele Forscher vermuten, dass die mesenterialen Lymphadenitiden nicht nur auf einer, sondern, wie auch aus dem oben Ausgeführten, schon hervorgegangen ist auf mehreren verschiedenen Ursachen beruhen, und betonen insbesondere, dass, da die Krankheit nicht nur eine ist, auch ihre Ätiologie nicht einheitlich sein kann.

Was nun den Beginn der Krankheit gerade im Ileocoecalwinkel betrifft, so hat man die Erklärung hierfür in den in dieser Gegend so gewöhnlichen entzündlichen Prozessen des Darmtraktes gesucht, die zur Entstehung sekundärer Lymphangitiden und -adenitiden Anlass geben sollten. Als Ursache dieser Lokalisation der erwähnten Entzündungen werden folgende Umstände angeführt: 1) die Verzögerung der Passage des Speisebreis, wenn er ins Coecum gelangt (PLAAS), 2) die mit der veränderten Reak-

tion desselben einhergehende Änderung in der Qualität der Bakterienflora und deren gesteigerte Virulenz (VAN DER REIS), 3) die Stase in dem pendelnden Coecum, derzufolge grossere Möglichkeiten für eine Läsion der Schleimhaut bestehen als weiter oben im Dunndarm. Dieselben Umstände tragen natürlich dazu bei die Resorption von Bakterien und toxischen Stoffen auch in solchen Fällen zu vermehren, in denen die Schleimhaut dieselben durchlässt, ohne selbst davon geschädigt zu werden. Man hat behauptet, dass dies insbesondere in der Appendix stattfinden konnte. Hiergegen macht jedoch WILENSKY geltend, dass die Appendix nicht als Infektionspforte in Frage kommen kann, weil deren Lymphgefässbahnen aufgrund seiner Untersuchungen gar nicht durch die Lymphdrüsen des Ileocoecalwinkels führen, wie bisher gelehrt worden ist.

Meine eigenen Untersuchungen erweisen lediglich, dass als Erreger der Gruppe von mesenterialen Lymphadenitiden, die ich untersucht und als »juvenilis« bezeichnet habe, der Tuberkelbazillus nicht in Frage kommen kann. Denn wenn dem so wäre, käme ja der *B. tub. bovinus* am ehesten in Betracht. Man muss aber bedenken, dass die Rindertuberkulose, die dann die natürlichste Infektionsquelle wäre, im Finnland heutzutage ausserst selten ist. Dagegen kann man die Frage, ob die in  $26 \pm 5,5\%$  der Fälle aus den Lymphdrüsen gezuchteten Bakterien nur die normalerweise darin anzutreffenden sind oder ob ihnen eine ätiologische Bedeutung zukommt (*B. coli commune*?), durch meine Untersuchungen nicht als geklärt betrachten. Am wahrscheinlichsten mutet es indessen an, dass das Vorkommen dieser Bakterien ebenso wie dasjenige der Darmschmarotzer ein blosses Zusammentreffen ist. Meine mit der Appendektomie erzielten ausgezeichneten Heilungsergebnisse deuten hin, dass die Appendix irgendeine Rolle in der Ätiologie der Krankheit spielen mag. Trotz des negativen Befundes in der Histologie der Appendix bin ich geneigt anzunehmen, dass sie grossere als diejenige der blossen Laparotomie sei. Nach der Rückkehr friedlicherer Verhältnisse fortzusetzenden Untersuchungen bleibt es vorbehalten, soweit möglich, aufzuklären, ob die Krankheit durch die Absorption von Bakterientoxinen oder giftigen Zersetzungsprodukten, die vielleicht von dem bei diesen Patienten so allgemein weiten und beweglichen Coecum begünstigt wird, oder durch ein bisher unbekanntes oder als Erreger einer anderen Krankheit (bei Tieren?) schon bekanntes Virus hervorgerufen wird.

## Schlussfolgerungen

Durch meine eigenen und die von mir zitierten Untersuchungen halte ich es für bewiesen, dass die von mir Lymphadenitis mesenterialis juvenilis benannte Krankheit nicht tuberkulos ist. Dagegen geben sie keinen Aufschluss über die genauere Ätiologie der Krankheit.

Als beste Behandlungsmethode hat sich die Appendektomie erwiesen. Gleichzeitig durfte die Entfernung der größten Lymphdrüsen in dem Falle am Platze sein, wo Anlass zu der Vermutung besteht, dass sie infolge ihrer Lokalisation später Störungen in der Funktion der Nachbarorgane hervorrufen können.

## Zusammenfassung.

Als Lymphadenitis mesenterialis juvenilis bezeichne ich eine fast ausschliesslich bei Kindern und Jugendlichen auftretende Krankheit (das Durchschnittsalter belief sich bei meinem Material auf 9 Jahre), bei der in der Gegend des Ileozokalwinkels oder auch weiter im Mesenterium zahlreiche vergrösserte, getrennte, knorpelfarbige durch das Peritoneum deutlich durchschimmernde Lymphknoten ohne Periadentitis auftreten, aber anderswo im Gedarme keine krankhaften Veränderungen zu sehen sind.

Meine Fälle umfassten 14 akute, 39 chronische und 47 rezidivierende. Bei  $34 \pm 47\%$  der Patienten trat Übelkeit oder Erbrechen, bei  $0\%$  wirkliche abwehrende Muskelspannung auf. Die Lymphknoten waren bei Gleitpalpationstechnik bei  $91 \pm 28\%$  fühlbar. Die Pirquet-Reaktion war positiv bei  $22 \pm 42\%$  meiner Patienten, aber bei  $243 \pm 11\%$  der gleichaltrigen Volksschüler der Gegend. Die Blutsenkung und das Blutbild waren durchaus nicht übereinstimmend.

Die Differentialdiagnose muss sich nur auf die typische Anamnese und das Palpationsergebnis gründen.

Die Behandlung bestand in Appendektomie.

Bei  $82 \pm 39\%$  der nachuntersuchten Patienten hörten die Beschwerden sogleich auf, bei  $8 \pm 27\%$  spätestens 2 Monate nach der Operation, und bei nur  $2 \pm 14\%$  dauerten sie länger (10–14 Monate). Bei den übrigen  $8 \pm 27\%$  erwiesen sich die weiter anhaltenden Beschwerden als auf anderen Ursachen beruhend. Die ganze Prozentzahl der Geheilten ist infolgedessen eigentlich  $98 \pm 14$ .

1 Appendix zeigte rezente Schleimhauttuberkulose, aber die übrigen waren alle gesund. In den Lymphknoten wurden weder Tuberkeln noch Nekrosen angetroffen. Ödem und Sinuskatarh waren bei den akutesten Fällen im allgemeinen am stärksten. Dagegen waren Retikulum- und Bindegewebswucherung auch bei den langwierigsten Fällen nur massig.

Aus 14 Lymphknotenproben wuchs *Bac coli commune*, aus 1 *Enterococcus* und aus 1 *Bac acidilact* sowie bei einem Koli-fall ausserdem *Streptococcus haemolyticus*. Die übrigen 48 waren steril, desgleichen auch alle 62 Lowensteinkulturen und 32 Meerschweinchenversuche.

Ich glaube behaupten zu können, dass die von mir abgesehene Lymphadenitisform nicht durch Tuberkulose, auch kaum durch Darmschmarotzer und noch viel weniger durch im Gedarm und in den Respirationswegen vorhandene Infektionen, die auch in den Anamnesen völlig fehlten, bedingt sein kann. Die Appendix mag eine heute noch nicht aufgeklärte Rolle in der Ätiologie der Krankheit spielen. Dagegen wage ich nichts über die ätiologische Bedeutung der in Kulturen gezuchteten Bakterien zu schliessen.

### Summary.

A disease, which occurs almost exclusively in children and young people (the mean age of the cases was nine years), is called by the author lymphadenitis mesenterialis juvenilis. It is characterized by numerous, isolated, cartilaginously coloured, enlarged lymph glands, without periadenitis, which are plainly visible through the peritoneum and are present in the ileocaecal angle region or are even widely spread over the mesentery, no other morbid changes being perceptible in the intestines.

The material at disposal contained 14 acute cases, 39 chronic ones and 47 relapses.

$34 \pm 4.7$  per cent of the patients suffered from indisposition or vomitings, actual preventive muscular exertions were not apparent in anyone of the patients. The glands were palpable by the method of glide palpation in  $91 \pm 2.8$  per cent of the patients. The Pirquet test was positive in  $22 \pm 4.2$  per cent of the patients, whereas this figure was  $24.3 \pm 1.1$  for the elementary school pupils of the same age and from the same neighbourhood. The sedimentation reaction and the blood picture again were quite dissimilar.

The differential diagnosis must be founded solely upon the typical case history and the outcomes of palpation

The cases were treated by appendicectomy

The pains immediately ceased in  $82 \pm 3.9$  per cent of the 96 patients subjected to after-examination, in  $8 \pm 2.7$  per cent of them at the latest two months after the operation and in  $2 \pm 1.4$  per cent only the troubles were of longer duration (from 10 to 14 months) In the remaining  $8 \pm 2.7$  per cent of the patients the continuing pains proved to be due to some other reason The entire percentage of the cured patients is consequently in fact  $98 \pm 1.4$

A fresh tuberculosis of the mucous membrane could be perceived in one of the appendices, all the other microscopically examined appendices were sound Neither tubercles nor necroses were observed in the glands The oedema and sinous catarrhs were in general more pronounced in the acute cases The proliferations of the reticulum and the connective tissue again were but moderate even in cases of long duration

14 of the gland samples gave growth to *Bac coli commune*, one to *enterococcus* and one to *bac acidilactici* and samples from a *coli* case furthermore gave growth to *streptococcus haemolyticus* All the remaining 48 samples were sterile, which was also the case with all the 62 Lowenstein cultures and the 32 guinea-pig tests

The author thus considers it possible to maintain that the kind of lymphadenitis indicated by him cannot be due to tuberculosis, hardly to intestinal parasites or still less to the banal infections of the intestines and the respiratory organs which are almost completely absent in the case history It is possible that the appendix plays a still unknown rôle in the etiology of the disease On the other hand the author does not venture to draw any conclusions regarding the etiological importances of the cultivated bacteria

### Résumé

Une maladie apparaissant presque exclusivement chez les enfants et les jeunes gens (l'âge moyen des cas examinés est de neuf ans) est appelée par l'auteur lymphadenitis mesenterialis juvenilis Elle se caractérise par de nombreuses glandes lymphatiques agrandies, isolées, cartilageusement colorées, sans périadénite, clairement visibles par le péritoine et siégeant dans la région du coin iléo-caecal ou étant même vastement répandues au-dessus

du mésentère, tandis qu'aucunes autres altérations s'observent dans le canal intestinal

Les matériaux en cause se portent sur 14 cas aigus, 39 cas chroniques et 47 cas de récidives

34  $\pm$  4 7 pour cent des malades ont eu des indispositions ou des vomissements et chez aucun des malades on n'a observé de tension musculaire préventive effective. Les glandes étaient palpables par la méthode de palpation à glissement dans 91  $\pm$  2 8 pour cent des malades. Le test de Piquet était positif dans 22  $\pm$  4 2 pour cent, tandis que le chiffre correspondant était de 24 3  $\pm$  1 1 chez les élèves des écoles primaires du même âge et de la même région. La réaction de sédimentation et le tableau sanguin étaient entièrement hétérogènes

Le diagnostic différentiel doit se baser uniquement sur l'anamnèse typique et le résultat de la palpation

Les cas ont été traités par l'appendicectomie

Parmi 96 malades soumis à un examen ultérieur les douleurs ont cessé immédiatement dans 82  $\pm$  3 9 pour cent, dans 8  $\pm$  2 7 pour cent au plus tard au bout de deux mois après l'opération et seulement dans 2  $\pm$  1 4 pour cent les troubles ont eu une durée plus longue (de 10 à 14 mois). Chez les cas restants, constituant 8  $\pm$  2 7 pour cent des malades, il s'est montré que les douleurs continues ont eu d'autres causes. Le pourcentage entier de malades guéris est par conséquent en effet 98  $\pm$  1 4

Dans un appendice on a constaté la présence d'une tuberculose fraîche de la muqueuse, tandis que tous les autres appendices qu'on a examinés par la voie microscopique ont été sains. Dans les glandes on n'a observé ni tubercules ni nécroses. Dans les cas aigus l'œdème et le catarrhe sinusal étaient en général plus prononcés. Par contre la prolifération du réticule et du tissu conjonctif n'était que modérée, même dans les cas de longue durée

14 des essais des glandes lymphatiques ont donné croissance au *Bac coli* commune, un à l'*enterococcus* et un au bacille acide lactique et les essais d'un cas à *coli* a donné croissance en plus au *streptococcus haemolyticus*. Tous les essais restants, au nombre de 48, étaient stériles, ce qui était aussi le cas quant à toutes les 62 cultures de Lowenstein et les 32 tests de cobayes

L'auteur considère pouvoir ainsi maintenir que la forme de la lymphadenitis indiquée par lui ne peut être due à la tuberculose, guère non plus à des parasites intestinales et encore moins aux infections banales des intestins et des organes respiratoires, les-

quelles ont aussi presque entièrement manqué dans l'anamnèse. Il est possible que l'appendice joue un rôle aujourd'hui encore inconnu dans l'étiologie de la maladie. De l'autre côté l'auteur n'ose pas tirer des conclusions à l'égard de l'importance étiologique des bactéries cultivées.

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## On the Late Results in Non-operated Cases of Malleolar Fractures.

### III

Fractures by Supination together with a survey of the  
late results in non-operatively treated malleolar fractures.

By

RAGNAR MAGNUSSON

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In fractures by supination the first injury is a transverse fracture of the lateral malleolus. The fracture line never runs proximal to the syndesmosis. As secondary injury there is a fracture of the internal malleolus, either in the form of a transverse fracture or as a chiselled fracture, with a more or less sagittal line of fracture (fig 1). As regards the appearance of the fracture of the internal malleolus, the bimalleolar fractures by supination have been divided up into two different types (ASHHURST and BROMER, PALMER et al). The two types differ from each other in another important respect. In the cases with a horizontal line of fracture in the internal malleolus there is practically never any dislocation of the fragments, at all events never to such a degree as to give a subluxation medial to the ankle joint (varus dislocation). On the other hand, such a dislocation is found in most cases with a sagittal line of fracture in the internal malleolus, and the dislocations in these cases are generally great (fig 1). — In accordance with the way they arise, there is *no rupture of the fork* in the fractures by supination, as was the case with the fractures by external rotation and by pronation.

127 cases in all have been classified as fractures by supination — 61 cases (44 unimalleolar and 17 bimalleolar) have been after-examined, corresponding to  $48.0 \pm 4.4\%$ . 10 of the after-exam-

Table 1  
*All the fractures by supination*

Sex	Unimalleolar			Bimalleolar		
	Number	P	(P)	Number	P	(P)
Men	58	58.0	± 1.9	15	55.6	± 9.7
Women	12	12.0	± 1.9	12	11.1	± 9.7
Total	100	100		27	100	

med bimalleolar fractures had a transverse line of fracture in the internal malleolus and 7 a sagittal line of fracture. Among these were 35 men and 26 women which corresponds to a percentual distribution of 57.1 and 12.6  $\pm$  6.3 respectively, among those not after-examined there were 38 men and 29 women, making 57.6 and 12.4  $\pm$  6.1 %. The sex distribution is thus the same among the after-examined and the not after-examined patients. The distribution of men and women over unimalleolar and bimalleolar fractures is seen from table 1.

The age distribution at the time of the accident is seen from table 2 and fig. 2. The average age of the men at the time of the accident is lower than that of the women. This is also evident when calculating the quartiles and the median. — There is no statistically significant difference in the mean age between the after-examined and the not after-examined patients. — The mean age at the time of the after-examination was 41.3  $\pm$  2.5 years.

Table 2  
*All the fractures by supination*  
Age at the time of the accident

	Number	$M \pm \sigma_n$	$\sigma$	$q^1$	Med	$q^3$
All the men	73	32.0 $\pm$ 1.6	13.9	20.1	30.9	41.8
All the women	54	45.9 $\pm$ 2.9	21.1	25.1	51.0	63.8
Total	127	37.9 $\pm$ 1.6	18.6	22.1	34.5	52.2
After examined	61	37.6 $\pm$ 2.5	19.3	19.5	34.5	55.5
Non after examined	66	38.2 $\pm$ 2.2	18.0	23.9	34.6	49.5



Fig 1



Number of  
cases

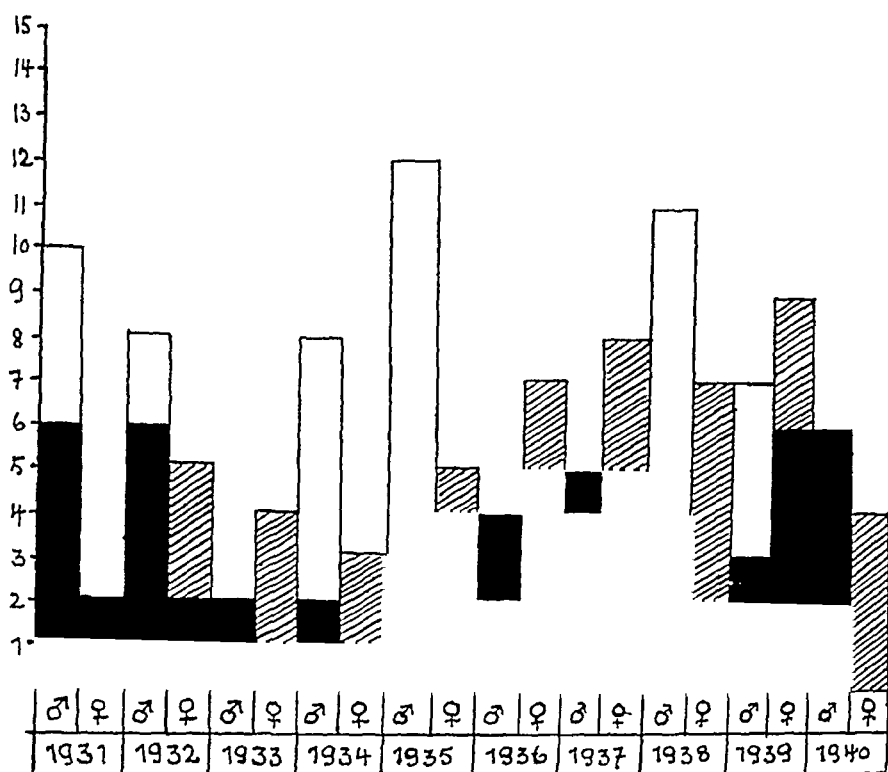


Fig 3 All the fractures by supination (127 cases) Distribution in years at the time of the accident

dent and the after-examination The distribution over years at the accident is seen from the diagram in fig 3 — Time of treatment etc is seen in table 3

The majority of the fractures by supination resulted from slipping, false steps etc, viz 85 cases 19 of the fractures occurred in traffic accidents and 11 at sports

There is no difference in time of treatment, time of immobilization or time for the first burdening of the injured foot between the after-examined and the not after-examined patients

#### Clinical After-examination

15 patients in all (8 men and 7 women) reported *subjective troubles* from the injured foot (24.6 %) 11 of these cases belong to the unimalleolar and 4 to the bimalleolar group The subjective troubles

within the first-mentioned group of fractures were in all cases slight and intermittent, while the troubles originating from the bimalleolar fractures were of a distinctly more serious type. All the patients with subjective troubles have however, been able to work full time.

No limitation of the mobility of the ankle joint on the injured side has been proved in any case, either in the unimalleolar or the bimalleolar fractures, which may, at least as far as it concerns the latter fractures, be due to the small number of after-examined cases.

An abnormal position of the injured foot has not been observed in any of the unimalleolar fractures. A *varus position*, localized only to the injured side, has been found in 4 of the bimalleolar cases, of which 3 had a sagittal line of fracture in the internal malleolus. Bilateral varus positions were found in another 4 cases, though considerably more marked on the injured side in 3 cases with sagittal line of fracture in the internal malleolus. — Thus, the majority of the cases with a clinically demonstrable varus position of the foot were found in the cases with a sagittal line of fracture in the internal malleolus. In these cases it was also found that the reposition had not been satisfactory, or that a dislocation had occurred during the time of treatment. — A bilateral pes plano-valgus was found in one case. A valgus position of the foot, localized only to the injured side, was not found in any case.

### Roentgenological After-examination

In all cases, unimalleolar and bimalleolar, the fractures of the lateral malleolus had healed without dislocation, except in one of the bimalleolar cases with sagittal line of fracture in the internal malleolus, where a pseud-arthritis of the lateral malleolus was observed.

At the roentgenological after-examination an impression of the articular surface of the tibia near the base of the internal malleolus was found in all the cases with a sagittal line of fracture in the internal malleolus. This impression has been accompanied by sclerosis in the subchondral bone tissue and by an irregularity of the joint contour. Similar changes, though far less developed, were found in some cases without primary dislocation of the ankle joint. — The impression in the articular surface of the tibia can

very probably be assigned to the influence of the medial border or the ankle joint at the accident

As mentioned above, there is *no widening of the fork* in fractures by supination. In bimalleolar fractures by supination with varus dislocation of the ankle joint it is, on the other hand, possible that there may be a *rupture* of the syndesmotie ligaments. As the fracture of the lateral malleolus is the first injury, the distal fragment is detached from the fibula at the moment when the medial subluxation takes place. It has also been shown that the distal fibular fragment always follows the medially subluxa-

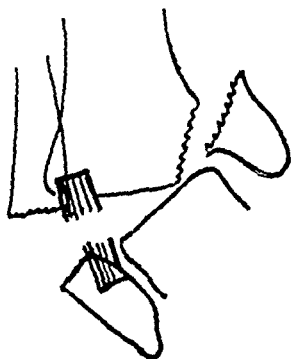


Fig 4

ted ankle, which must result in a strong pulling of the syndesmotie ligaments. If the force is sufficient to cause great dislocation, the strain on the syndesmotie ligaments may become so great as to injure them, too, (fig 4, cf also fig 1). As so great a varus dislocation of the ankle only occurs in the cases with sagittal line of fracture in the internal malleolus, it is only in these cases that an accompanying injury to the syndesmotie ligaments may be expected. The injuries to these ligaments may presumably be of the kind found in fractures by external rotation and by pronation, i. e. either in the form of a rupture from the insertion of the ligaments into the fibula, with or without bone fragments (LE FORT's fracture), or as a rupture of the ligament itself, or finally as a rupture from the insertion of the ligament into the tibia, with or without a fragment. The first-mentioned of these possibilities seems to me the least likely. — As has been mentioned earlier regarding the fractures by external rotation and by pronation, it is the injuries to the anterior syndesmotie ligaments, that have been demonstrable in these fracture types, while injuries

involving the posterior syndesmotie ligament have not been found in any *certain* case, this may partly be due to the fact that only one X-ray projection has been used. The same holds for the fractures by supination. Here then, as in the fracture types treated above, it is the changes within the anterior tibial tubercle which primarily indicate an injury to the anterior syndesmotie ligaments. Of 7 cases with great primary dislocation of the ankle joint clear changes within the anterior tibial tubercle were found in 5 (contour changes), and a definite pseud-arthritis<sup>1</sup> in one. In some cases without any certain primary dislocation, minor changes within the anterior tibial tubercle were found at the after-examination, these might be interpreted as contour changes. — Syndesmotie injuries in cases of fractures by supination have, as far as I know, not been discussed before in the literature.

From the *point of view of treatment*, it may be important to take into account the possibility of an injury to the syndesmosis in some fractures by supination also. Thus, over-correction and fixation in over-corrected position may be expected to result in a widening of the syndesmosis and, consequently, give a permanent diastasis in the syndesmosis.

An *arthrosis deformans*, localized solely to the injured side, has been found in only 2 of the unimalleolar fractures by supination ( $4.5 \pm 3.1\%$ ), in both cases to a very slight degree. Unilateral deforming changes were found in 11 of the bimalleolar fractures (5 men and 6 women), making  $64.7 \pm 11.8\%$ . 7 of these after-examined cases had primary subluxation of the ankle joint, while there had been no primary dislocation in the remaining 4 cases of arthrosis deformans. It seems fairly natural that the cases with more serious primary injuries should tend towards a greater frequency of arthrosis deformans than the cases without dislocation and without greater injuries to the soft parts. In the cases with subluxation of the ankle joint a persisting diastasis in the malleolar fork may also be, if not the sole cause, at any rate greatly contributing to the great deformans frequency. In these cases there is a primary widening of the fork *through dislocation of the internal malleolus* and such a widening may also become permanent from an unsatisfactory reposition or from a redislocation taking place during the time of treatment. As stressed above, it is difficult if not impossible to diagnose roentgenologically

<sup>1</sup> See R. MAGNUSSEN. On the late results etc., pag. 43 and following.

Table 4

*Various degrees of severity of arthrosis deformans, distributed over the fracture groups within the fractures by supination*

Fracture group	(+)	+	++	+++	Total
Unimalleolar	2	—	—	—	2
Bimalleolar	4	—	5	2	11
Total	6	—	5	2	13

smaller diastases in the malleolar fork in cases of widening of the fork due to rupture of the syndesmosis. It is the same with widenings of the fork due to a medial dislocation of the internal malleolus in the cases where this dislocation is very small, which is generally the case with treated fractures. — The higher frequency of arthrosis deformans in the cases with primary subluxation (making a reservation for the small number of after-examined cases) compared with that in the cases without subluxation might be ascribed to the injuries of the soft parts originating from the accident, combined with an instability in the joint caused by an increased width of the fork. — The degree of severity of the deforming changes within both fracture groups is seen from table 4.<sup>1</sup> As to the causes of arthrosis deformans among the bimalleolar fractures the 4 cases with slight changes belong to the fractures without primary dislocation, while the remaining 7 cases with serious deforming changes had a primary subluxation of the ankle joint. — In fractures by supination with a subluxation of this kind there is thus not only an increased frequency of arthrosis deformans but also considerably more serious types of deforming changes than in the cases without primary subluxation.

### Comparative survey of the late results in non-operated cases of malleolar fractures.

The author now intends to give a collective survey of the late results in different types of fractures. The late results from some small fracture groups will also be included (isolated fractures of the posterior tibial margin, fractures by means of violence acting

<sup>1</sup> See R. MAGNUSSON On the late results etc, pag 107

in the longitudinal axis of the leg and malleolar fractures resulting from direct violence) which have not been treated earlier on account of the small number of cases within each separate group

### Subjective symptoms.

134 patients of the 412 after-examined have reported troubles from the ankle of the injured side ( $32.5\%$ ). 72 of 229 after-examined men had subjective troubles ( $31.4 \pm 3.1\%$ ) and 62 of 183 after-examined women ( $33.9 \pm 3.5\%$ ). Men and women have thus had subjective troubles to the same extent — Nor does age seem to have any part in the development of the subjective symptoms. The mean age at the time of the after-examination for the cases with subjective complaints was  $47.2 \pm 1.4$  years and for the cases without subjective symptoms  $44.3 \pm 1.0$  years. The difference is  $2.9 \pm 1.7$  years, thus not statistically significant.

When examining the distribution of the subjective troubles over "simpler" and "more difficult" types of fractures,<sup>1</sup> it is found that  $30.2 \pm 2.7\%$  of the former had subjective troubles and  $45.1 \pm 5.5\%$  of the latter. The difference is here  $14.0 \pm 3.2$ , thus statistically significant, which indicates that subjective troubles are more common after "more difficult" than after "simpler" fractures.

As to the importance of a fracture of the posterior tibial margin for the subjective symptoms, HENDELBERG has pointed out that of the cases which, together with posterior fragments had a fracture of the fibula only, the results are functionally unsatisfactory in  $10.5 \pm 7.0\%$ , and in "trimalleolar" fractures in  $41.2 \pm 6\%$  (HENDELBERG calls those results functionally unsatisfactory where the patients "cannot perform their usual work or are unable to walk longer stretches"). When examining the present material from this point of view it is found that, among the cases with fracture of the posterior tibial margin + fracture of the fibula (i. e. fractures by external rotation), 13 of the 29 after-examined cases of this type have subjective troubles, of which the result in one case may be labelled functionally unsatisfactory, according to HENDELBERG. I have a total of 50 after-examined

<sup>1</sup> The "simpler" fractures here include all unimalleolar fractures with and without fracture of the posterior tibial margin and the bimalleolar fractures, the "more difficult" fractures include the bimalleolar with fracture of the posterior tibial margin, fractures by luxation and bimalleolar fractures by supination with sagittal line of fracture in the internal malleolus.

cases of 'trimalleolar' fractures (fractures by external rotation and by pronation), with subjective symptoms in 21 cases. All these patients could perform their work to the full, however, and the results may thus be called functionally satisfactory. In the present material there is thus no increase of the functionally unsatisfactory results in the 'trimalleolar' fractures.

The importance of the posterior fragment *per se* in the development of subjective symptoms can be studied in the cases with isolated fractures of the posterior tibial margin. 12 such cases have been after-examined, of which 3 had slight subjective troubles. All 3 patients were able to work full time, however. In one of these cases there was a *primary* dislocation downwards, while, at the *after-examination*, a cranial dislocation of about 1 mm was observed. Thus, it can be said that posterior fragments in the present material have not proved to increase the frequency of subjective troubles.

The distribution of the cases with subjective symptoms in the cases with and without arthrosis deformans is rather interesting. It has long been known that even very serious deforming changes may proceed without any symptoms at all. — It has been mentioned earlier that no correspondence between the subjective symptoms and arthrosis deformans could be established in the fractures by external rotation.<sup>1</sup> If the whole material is examined in this respect, it is found that 46 of 184 cases without roentgenological signs of arthrosis deformans had subjective troubles, making  $25.0 \pm 3.2\%$ , and that 71 of 188 cases with deforming changes localized solely to the injured side had subjective troubles, making  $37.8 \pm 3.5\%$ . The difference is less than 3 times but greater than 2.5 times the standard error, which denotes a statistical probability for a coincidence between subjective symptoms and unilateral arthrosis deformans. — No less than 17 of the 40 cases with *bilateral* deforming changes in the ankle joint had subjective symptoms, making  $42.5 \pm 7.8\%$ . The number of cases is too small, however, to permit of any *certain* comparisons with the previous types, but it seems rather likely that the cases with bilateral deforming changes have subjective symptoms to a very great extent.

It has not been possible to obtain any *certainly* demonstrable causes of the development of subjective symptoms after malleolar fractures. As mentioned above, many of the subjective symptoms

<sup>1</sup> See R. MAGNUSSON. On the late results etc.

may probably be referred to factors which are not directly connected with the fractures, as weight, bad circulation (varices, arteriosclerosis etc) and probably also mental worry

Within some fracture groups a *limited mobility* of the ankle joint has been observed. As the available clinical methods of measurement are extremely rough, the results are not especially trustworthy, so that I do not intend to discuss them in more detail — I want to point out, however, that a *certain* limitation of the plantar flexion has not been found in any case. As to the reason for this, I have earlier pointed out that it might be that the foot has been immobilized in the equinus position, by which procedure a shortening of the Achilles tendon may very easily occur

The origin of the so-called post-traumatic valgus foot has been widely discussed in the literature. In the present material, which contains 412 after-examined malleolar fractures, a total of 44 cases of a valgus position of the foot, localized only to the injured side, was found (10.7 %). It should, however, be noticed that a valgus position of this kind was found in none of the fractures by supination, but only in the fractures by external rotation and by pronation. This fact points to where the cause of the post-traumatic valgus foot should be sought. The fractures by external rotation and by pronation both result from a more or less lateral dislocation tendency of the ankle joint, when a rupture or stretching of the medial ligaments may take place. Through unsatisfactory reposition or too short immobilization time a state of insufficiency of the medial ligaments may develop. The deltoid ligaments may be of especial importance in this connection. The opinion advanced here is supported to a certain degree by the fact that 10 of the 118 after-examined unimalleolar fractures by external rotation had a valgus position localized only to the injured side, while no unilateral valgus position was found among 44 cases of unimalleolar fractures by supination. In the first-mentioned fractures the medial ligaments are injured, but not in the latter. (Both these types of fractures have a fracture of the lateral malleolus.)

The frequency of an *arthrosis deformans* localized solely to the ankle joint of the injured side varies both in quantity and quality within different types and groups of fractures. The most serious forms have been found in the fractures by pronation and by supination. A marked widening of the fork may take place in

Table 5.

*Average age and age median at the after-examination of the cases without deforming changes, with unilateral and with bilateral arthrosis deformans*

(All cases of indirect malleolar fractures)

	Average age (in years) at the after examination	Med
Cases without deforming changes (173 cases)	35.1 $\pm$ 1.1	33.5
Cases with unilateral deforming changes (179 cases)	49.9 $\pm$ 1.1	50.4
Cases with bilateral deforming changes (40 cases)	59.0 $\pm$ 2.5	62.5

both fracture types, by means of a total rupture of the syndesmosis in the fractures by pronation and by means of dislocation of the internal malleolus in the fractures by supination. The latter is especially true in the cases with a sagittal line of fracture. The possibility of a persisting diastasis in these fractures is therefore great in those cases where the reposition has been unsatisfactory or where a secondary dislocation has taken place. It is probably these circumstances in particular which cause the more serious deforming changes.

A roentgenologically demonstrable arthrosis deformans, localized solely to the injured side of the ankle joint, was found in a total of 179 of 392<sup>1</sup> after-examined cases of indirect malleolar fractures, corresponding to 45.7 %. *Thus nearly half of all the malleolar fractures by indirect violence have shown certain deforming changes at the after-examination.*

As has been pointed out above, the changes brought about by the fractures are not the only cause of the unilateral arthrosis deformans. Age plays a certain rôle, too. This stands out clearly when surveying the collected material (table 5). There is a statistically significant difference between the mean age in the cases without deforming changes, with unilateral and with bilateral arthrosis deformans. The difference in age also comes out well when calculating the medians for the three groups (table 5). Half the cases without deforming changes are less than 33.5 years old, and half the cases with unilateral and bilateral arthrosis

<sup>1</sup> The cases resulting from direct violence (10 cases) have been excluded as well as 10 cases which have been impossible to classify.

Table 6.

*Distribution of age at the time of the after-examination in the cases without deforming changes, with unilateral and with bilateral arthrosis deformans*

(All cases are classified as indirect malleolar fractures)

A g e	All cases		Cases without deforming changes		Cases with unilateral deforming changes		Cases with bilateral deforming changes	
	Number	%	Number	%	Number	%	Number	%
10—19	31	7.9	30	17.4	1	0.6	—	—
20—29	67	17.1	42	23.9	22	12.3	3	7.5
30—39	68	17.4	41	23.8	25	14.0	2	5.0
40—49	81	20.7	35	20.3	40	22.3	6	15.0
50—59	55	14.0	12	6.9	37	20.7	6	15.0
60—69	62	15.8	8	4.7	42	23.4	12	30.0
70—79	25	6.3	5	3.0	10	5.6	10	25.0
80—89	3	0.8	—	—	2	1.1	1	2.5
Total	392	100.0	173	100.0	179	100.0	40	100.0

deformans respectively are less than 50.4 and 62.5 years old respectively. The frequency of the cases without arthrosis deformans, with unilateral and with bilateral changes within the different age groups is seen from table 6 and the diagram in figure 5. They show that the age curve for the *whole* material is practically normal, while the curve of the cases without arthrosis deformans shows a negative skewness, and the curves of the cases with unilateral and with bilateral deforming changes show a positive skewness. The cases without deforming changes have a maximum in the ages from 20—39 years. The cases with unilateral arthrosis deformans are most frequent in the ages from 40—69 years, while the maximum of the cases with bilateral changes lies between 60—80 years.

The investigation of the late results in conservatively treated malleolar fractures, here brought to an end, has shown a rather high frequency of persisting subjective symptoms, arthrosis deformans etc. It is remarkable, however, that only 9 patients of 412 (making 2.2 %) after-examined patients have shown a functionally bad result in so far as they have been nearly or quite

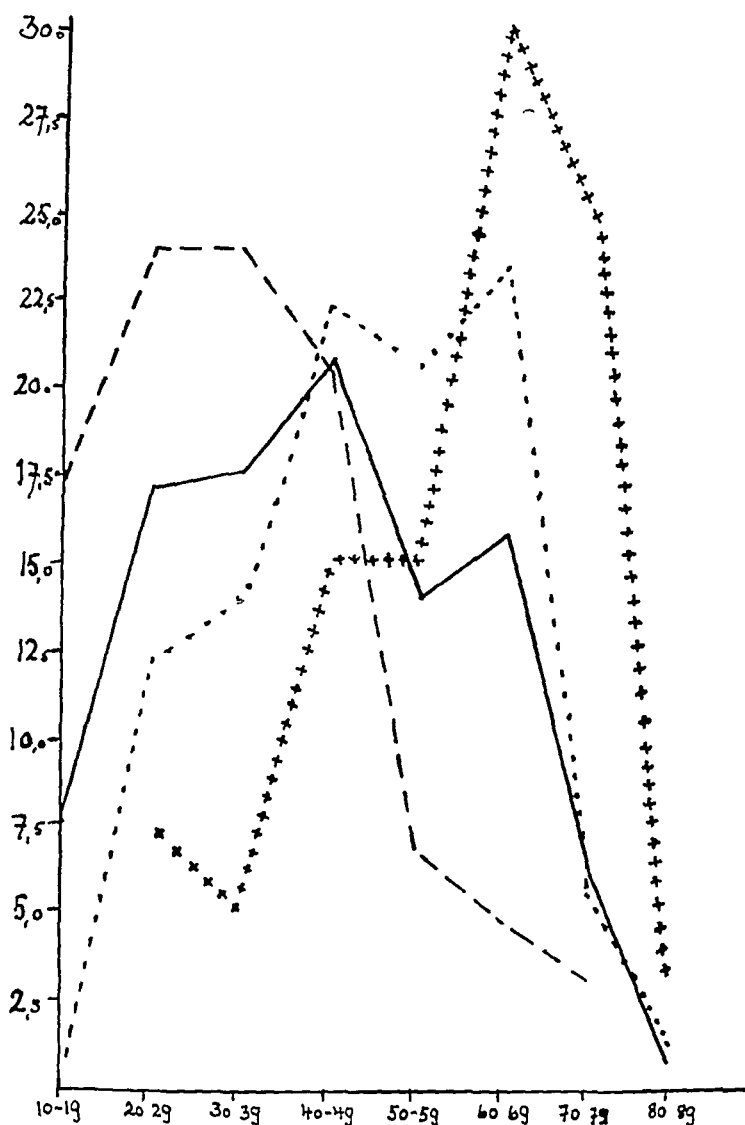


Fig 5 The percentual distribution within different age groups of the cases without deforming changes in the ankle joint, the cases with unilateral and with bilateral changes ————— = all the after examined patients (412 cases), - - - - - = cases without deforming changes (179 cases), . . . . . = cases with unilateral deforming changes (178 cases), + + + + + = cases with bilateral deforming changes (40 cases)

unable to perform their work. No less than 3 of the cases with a functionally bad result were found among the fractures by violence acting in the longitudinal axis of the tibia.

Several authors have spoken in favour of more active measures than those generally resorted to in cases of malleolar fractures

They advocate surgical reposition and fixation, possibly with screwing of the syndesmosis. Many cases will, of course, require such a therapy, but my opinion is that the results of the conservative therapy might be still more improved if the fracture were always very carefully repositioned and the normal width of the malleolar fork restored, the patient being furthermore kept immobilized and not allowed to lean on the foot until it is quite certain that a secondary dislocation of the fragments or a secondary widening of the fork is impossible.

Generally speaking, the immobilization times in the present material have been too short. This refers to all fracture groups and fracture types. — As regards the fractures by external rotation,<sup>1</sup> the unimalleolar fractures have an average time of immobilization of only 27.4 days. Considering that these fractures always have an injury to the tibio-fibular joint, a fixation time of 6 weeks would seem to be suitable. The more serious fracture types (bimalleolar with fracture of the posterior tibial margin, and fractures by luxation) need a fixation time of 8—12 weeks instead of the 7 and 7.5 weeks respectively of the present material.

Turning to the fractures by pronation, these show an even lower time of immobilization than the fractures by external rotation.<sup>2</sup> In this case, too, the fixation time in the milder cases (unimalleolar with and without fracture of the posterior tibial margin) should not be less than 6 weeks, as all fractures by pronation are accompanied by injuries to the tibio-fibular joint. The immobilization time for the other fracture types should not be less than 9—12 weeks. As a rule one ought to allow for a longer fixation time for the fractures by pronation than for the fractures by external rotation, as the first-mentioned are most probably accompanied by more extensive injuries to the tibio-fibular joint.

As to the fractures by supination, finally, the immobilization time of 22 days used in the present material must be considered sufficient. There is practically never any dislocation of the fracture in these cases and never any injuries to the tibio-fibular joint. A fixation time for the bimalleolar fractures of 47 days is, on the other hand, too short, and this refers especially to the fractures with medial subluxation of the ankle joint. In these latter cases the time of immobilization has varied between 37 and 93 days. Considering the pronounced tendency to secondary varus position

<sup>1</sup> See R. MAGNUSSEN. On the late results etc., table 22, pag. 99.

<sup>2</sup> See R. MAGNUSSEN. On the late results etc., table 3, pag. 166.

the time of immobilization should here be not less than 12—13 weeks

In order to obtain satisfactory results it is important that the foot is not rested on too early. This refers especially to the fracture types where the fragment has a marked dislocation tendency (*fracture of the posterior tibial margin and the bimalleolar fractures by supination with sagittal line of fracture*). The patients in the present material have as a rule been permitted to rest on the injured foot too early. It must be remembered that a dislocation may take place even within the most perfectly modelled plaster. As the tibio-fibular joint is especially strained when the foot is rested on, patients with fractures accompanied by an injury to the tibio-fibular joint should not be permitted to rest on the foot until after 3—4 weeks at the earliest in the simpler fracture types, and, in the more serious types, after a still longer time, depending on the appearance of the fracture in general.

### Summary.

61 cases of fractures by supination from the 10-year period 1931—1940 have been after-examined clinically and roentgenologically — Time of treatment etc. is found in table 3 — 24.6 % of the patients reported subjective troubles from the injured foot. All of them have, however, been able to perform their work to the full — 4 cases of varus position, all belonging to the bimalleolar group, have been observed, but no case of valgus position — Widening of the fork does not occur in fractures by supination. The author has, on the other hand, been able to show that a *rupture* of the syndesmotic ligament may occur in bimalleolar fractures with great varus dislocation (fig 4, cf. also fig 1) — An arthrosis deformans, localized only to the ankle joint of the injured side, was found in 4.5 % of the unimalleolar fractures (44 after-examined cases), and in 64.7 % of the bimalleolar fractures (17 cases after-examined).

A comparative survey of the late results in non-operated cases of malleolar fractures is given in the last section of the essay — 32.5 % of 412 after-examined malleolar fractures have subjective troubles from the ankle joint of the injured side. There is no difference in frequency between men and women. Age does not seem to have anything to do with the subjective symptoms. Their fre-

quency is, on the other hand, greater in more difficult than in slight fracture types. There is a statistical probability that deforming changes in the ankle joint will give rise to subjective symptoms more often than cases without such changes. — The post-traumatic valgus foot is probably due to insufficiency in the medial ligaments. — A roentgenologically verified arthrosis deformans in the ankle joint of the injured side is found in 45.7 %. Not only anatomical changes but also age plays a rôle in the onset of the deforming changes (tables 5 and 6 and fig. 5).

The times of immobilization in the present material have been too short. It is further evident that the patients have been permitted to lean on the injured foot too early. Finally the author gives the suitable times of immobilization for the different types of fractures.

### Zusammenfassung.

61 Fälle von Supinationsfrakturen aus der Zeit von 1931—1940 sind klinisch und roentgenologisch nachuntersucht worden. — Behandlungsdauer usw. ist aus der Tabelle 3 zu ersehen. — 24.6 % von den Patienten haben subjektive Beschwerden von Seiten des beschädigten Fusses gehabt. Alle haben jedoch ihre Arbeit in vollem Umfange ausführen können. — 4 Fälle von Varusstellung, die alle der bimalleolaren Gruppe angehören, aber kein Fall von Valgusstellung sind festgestellt worden. — Gabelwertung kommt bei den Supinationsfrakturen nicht vor. Veif hat dagegen zeigen können, dass bei den bimalleolaren Frakturen mit starker Varusdislokation eine *Absprengung* der Syndesmosisbänder entstehen kann (Abb. 4, vgl. auch Abb. 1). — Eine ausschliesslich an dem Talo-cruralgelenk der beschädigten Seite lokalisierte Arthrosis deformans fand sich in 45.7 % von den unimalleolaren (44 Fälle nachuntersucht) und in 64.7 % von den bimalleolaren Frakturen (17 Fälle nachuntersucht).

Der letzte Teil des Aufsatzes gibt eine vergleichende Übersicht der Spätergebnisse in Fällen von nicht-operierten Malleolarfrakturen. — 32.5 % von 412 nachuntersuchten Malleolarfrakturen haben subjektive Beschwerden. Kein Unterschied in der Frequenz subjektiver Beschwerden zwischen Männern und Frauen ist gefunden worden. Das Alter scheint für die Entstehung subjektiver Beschwerden keine Rolle zu spielen. Die Frequenz ist dagegen grösser bei schwereren als bei leichteren Frakturformen.

Statistisch ergibt sich mit Wahrscheinlichkeit, dass Fälle mit deformierenden Veränderungen im Talo-cruralgelenk häufiger subjektive Symptome machen als Fälle ohne derartige Veränderungen — Die Entstehung des post-traumatischen Valgusfusses beruht wahrscheinlich auf einer Insuffizienz des medialen Ligamentapparates — Eine röntgenologisch bestätigte Arthrosis deformans in dem Talo-cruralgelenk der beschädigten Seite wurde bei 45 7 % der Fälle gefunden Für die Entstehung der deformierenden Veränderungen spielen nicht nur die anatomischen Veränderungen sondern auch das Alter eine Rolle (Tab 5 und 6 sowie Abb 5)

Die Immobilisationszeiten des hier publizierten Materials sind fast immer zu kurz gewesen Es ist ebenso klar, dass es den Patienten zu früh erlaubt ist den beschädigten Fuss zu belasten Verfügt am Ende des Aufsatzes die besten Immobilisationszeiten der verschiedenen Frakturtypen an

### Résumé.

61 cas de fractures par supination, recueillis pendant la période de dix ans 1931—1940, ont été examinés cliniquement et radiologiquement en vue des résultats éloignés Durée de traitement etc donnée au diagr 3 — 24 6 % déclarent avoir eu des troubles subjectifs du pied lésé Tous ont tout-de-même gardé leur pleine capacité de travail 4 cas de pieds varus, dont tous appartenaient au groupe bimalléolaire, ont été constatés, mais aucun cas de pied valgus — Il n'existe pas d'élargissements totaux dans les fractures par supination Par contre, il nous a été possible de démontrer une *rupture* des ligaments syndesmotiques dans les fractures bimalléolaires avec grande dislocation varus (fig 4, comp aussi fig 1) — Une arthrose déformante, localisée seulement du côté lésé du cou-de-pied, a été trouvée dans 4 5 % des fractures unimalléolaires (dont 44 cas examinés en vue des résultats éloignés) et dans 64 7 % des fractures bimalléolaires (17 cas examinés en vue des résultats éloignés)

La dernière partie de l'essai donne un résumé comparatif des résultats éloignés dans des fractures malléolaires non-opérées — 32 5 % des 412 cas de fracture malléolaire, examinés en vue des résultats éloignés, ont des troubles subjectifs du côté lésé du cou-de-pied Il n'y a pas de différence de fréquence chez les deux sexes

Il ne semble pas que l'âge joue de rôle pour le développement des troubles subjectifs. La fréquence en est au contraire supérieure dans les types de fractures plus graves que dans les fractures plus simples. Il y a une probabilité statistique que les cas avec changements déformants du cou-de-pied feraient développer des troubles subjectifs plus souvent que les cas sans pareils changements — L'étiologie du pied valgus post-traumatique est probablement due à une insuffisance des ligaments médiaux — Une arthrose déformante dans le cou-de-pied du côté lésé a été vérifiée dans 45,7 % des cas. Non seulement les changements anatomiques mais l'âge aussi jouent un rôle dans le développement des changements déformants (diagr 5 et 6, fig 5).

La durée de l'immobilisation du matériel a presque toujours été trop courte. On peut aussi dire que les malades ont été permis d'employer le pied lésé trop tôt. A la fin de l'essai l'auteur dénote la meilleure durée de l'immobilisation dans les différents types de fractures.

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## Pneumoperitoneum treated with Puncture and Injection of Sulfathiazole.

Report of One Case

By

ALFRED ZACHO

The following deals with a case of pneumoperitoneum interesting on account of the treatment applied

B B H Dep A Case Rec No 2922/11 On March 17, 1913 a 68 year old man was admitted with a diagnosis of ileus For the last year or so he had been suffering from irregular stools and periodical diarrhoea for the last couple of months accompanied by fatigue, seediness and in his own opinion, loss in weight

The attack which caused the hospitalization had lasted a week It had started with intermittent pain in the lower part of the abdomen The pain had gradually grown more intense and at the time of admission it was constant In spite of the administration of purgatives, the bowels had not moved for a week

On admission the patient's general condition was not greatly affected He was pale and somewhat dyspnoeic, but the pulse was regular and strong Temperature  $37.1^{\circ}$  centigrade

The abdomen was enormously distended and tympanitic, but without intestinal pattern The dullness of the liver was completely obliterated, but there was no muscular rigidity

The X-ray examination (Figs 1 and 2) revealed an immense accumulation of free gas in the peritoneal cavity In the upright position the liver appeared freely suspended in its ligaments in the air-filled cavity, and the horizontal position revealed the intestine lying in loops at the bottom of the enormously distended abdomen Besides, there was some free fluid among the intestinal loops

There was nothing to indicate whence the gas came It was attempted to solve the problem, partly by giving a small amount of barium by mouth, partly by means of a cautiously administered contrast enema into the colon The procedure gave no result apart from revealing that the contrast medium at least passed into the ascending colon

Apart from the presence of gas there were no symptoms of acute



Fig 1 Roentgenogram of the abdomen, interior view



Fig 2 Roentgenogram of the abdomen, lateral view

ZACHO Pneumoperitoneum treated with puncture



perforation and therefore it was considered best to wait and see, mainly because it was impossible to know where to seek a perforation, if any, and because it probably would escape detection on account of its presumed smallness

But already on the same day the patient developed cardiac insufficiency with violent dyspnoea and a thready, rapid pulse. It was considered to be a consequence of the enormous distension of the abdominal cavity, for which reason it was decided to let the air out. By means of a puncture needle large quantities of completely odourless gas followed by a small amount of dusky fluid were evacuated, whereupon the abdomen gradually subsided and became quite flat. 5 grammes of sulfathiazole suspended in a saline solution were injected into the peritoneal cavity after the gas had been let out. The tapped fluid had a slightly alkaline reaction, contained numerous leukocytes, and bacteriological examination revealed growth of *Bacilli coli* and sparse Gram positive cocci.

The patient's condition improved immediately upon the puncture, and considering that the abdomen now was quite soft, it was decided to continue with a conservative treatment. To be on the safe side the patient was given sulfathiazole for 5 days, to begin with 2 grammes and then 1 gramme every 4th hour for 48 hours, thereupon 1 gramme four times daily. Already on the day after the puncture there was discharge of ample, soft faeces and spontaneous expulsion of flatus. The temperature which had been 38° centigrade on the evening of the puncture, did not rise further, but gradually went down to normal values.

The subsequent examinations failed to reveal the site of the perforation. On the other hand, the faeces constantly gave a positive benzidine reaction and the sedimentation rate of the erythrocytes was enhanced (33 mm per hour). An explorative laparotomy was contemplated, but partly the patient was disinclined to undergo a surgical intervention, partly his condition was not considered satisfactory enough to stand a major operation. Therefore he was discharged a month after the hospitalization in order to gain in strength. A few months later he was re-admitted, this time with an unmistakable ileus of the large intestine. X-ray revealed a constriction in the sigmoid flexure of the colon, but it was impossible to decide whether it was of a neoplastic or inflammatory nature. Caecostomy was performed. Numerous adhesions made a palpation of the sigmoid flexure impossible. The post-operative course was uneventful, and the patient was discharged to convalesce. He refused further operations, and not until about one year after the first hospitalization did he return in order to have the caecostomy closed. This time he was persuaded to submit to a radical operation. At the junction between the sigmoid flexure and the rectum there was a mobile tumour, the size of a hen's egg, which was removed by the method of BLOCH-MIKULICZ. The sigmoid flexure was violently dilated and hypertrophic. On microscopical examination the tumour proved to be an adeno-carcinoma. About a month later the caecostomy was closed. Recovery uneventful. Feeling well on discharge.

The term pneumoperitoneum actually only indicates the presence of gas in the peritoneal cavity. As apparent from the below, the gas may be of widely different origin. The scarce "free gas" in the peritoneal cavity demonstrable by X-ray most frequently only is a symptom of other lesions. As a rule, however, the term is reserved for cases of a characteristic picture due to the violent distention of the abdomen in which cases the primary cause is unknown or only gives rise to less conspicuous symptoms, so the condition gives the impression of being a disease *sui generis*.

The causes of free gas in the peritoneal cavity may be the following

(1) Injury to the abdominal wall, accidental or intentional, like e. g. laparotomies, laparoscopies, and paracenteses of the abdomen. By X-ray LAURELL has demonstrated gas in the peritoneal cavity as late as 3 weeks after laparotomies.

(2) Traumatic or spontaneous perforations of the stomach or intestinal canal. Free gas in the peritoneal cavity is a well-known phenomenon in the case of perforations caused by gastric or duodenal ulcers, but may also be met with in the case of perforations of the remainder of the intestinal canal caused by appendicitis, cancer, ileus, diverticula, tuberculous or typhic ulcers. In this connexion it is worth mentioning that X-ray examinations of patients suffering from gastric ulcers now and then accidentally reveal small amounts of free gas (KAALUND and others).

(3) Air may escape into the peritoneal cavity during RUBIN's insufflation through the oviducts, and the presumption has been advanced (MOBERG) that air may find its way into the peritoneal cavity through the internal genitals of women on other occasions too (unigations, vomiting).

(4) According to URBAN, ACHMATOWICZ and others pneumoperitoneum sometimes may be encountered in connexion with *pneumosis cystoides intestinalis*, the human variety of which BANG was the first to describe (1876). The general opinion is that the pneumoperitoneum is caused by the bursting of the vesicles, whereupon the air is pressed from the bowel into the peritoneal cavity instead of into the subserous tissue.

(5) In case of pneumoperitoneum without a demonstrable cause it has been attempted to explain the presence of the gas by bacterial activity (FRUND, STEGEMANN, MICHEJDA and others). The theory has met energetic opposition from e. g. LOHR and COENEN who dispute the justification of the term "gas peritonitis" on a

bacterial basis introduced by German authors (FRUND), and correctly contend that none of the authors in question ever found bacteria in the peritoneal cavity

(6) The cause of the pneumoperitoneum has been unknown in most of the published cases. Actually this is not strange, since the failure to find the cause probably is the main reason why the cases were published. Only very few authors — 1 a WILMANN — have published their cases after the natural cause has been found (perforation by gastric ulcer). A large number of these so-called puzzling cases have occurred following operations, not only intraperitoneal (FALKENBURG, D'ALLAINES), but also extra-peritoneal intervention like prostatectomy (FRUND) or bladder operations (ALLEMANN). In these cases presumably a post-operative intestinal paralysis presses the air through a tiny crack in the stomach or intestinal wall, seeing that a number of cases have been encountered in connexion with ileus conditions (ONACA & KOVACS, ACHMATOWICS). In all probability a similar explanation applies to the case under discussion which no doubt had a subileus during the week preceding the hospitalization. It is a well-known fact that gaseous distention of the stomach may cause an escape of air into the peritoneal cavity without other peritoneal symptoms, e. g. by gastroscopy (SCHINDLER & RENSLOW).

The first report of pneumoperitoneum seems to be the one published by FALKENBURG (1913). In Denmark one case has been reported by V. THUN (1921) and in Sweden by HOLMGREN (1937). Perusing the literature, COENEN (1939) found 75 cases, 32 of which were due to perforating gastric and duodenal ulcers.

In typical cases the clinical symptoms are marked by the violent distention of the abdomen and resulting dyspnoea and cardiac insufficiency, exactly like the case reported in the present paper. Rarely the lesion may follow a more chronic course (HOLMGREN).

Generally the diagnosis seems to have caused some difficulty, and only a minority of the cases have been diagnosed before the operation. No doubt modern times will bring a change in this respect, considering the extensive use of X-ray in the case of acute abdomen. Where X-ray is not available, the absence of intestinal pattern and the obliteration of the liver dullness should contain the clue to the correct diagnosis.

Apart from a few cases of pronounced pneumoperitoneum cured without operation (SCHNITZLER), the treatment in most cases has

been laparotomy, often on account of the erroneous diagnosis of ileus (MICHEJDA, WILMANN) or in the post-operative cases in order to perform an enterostomy because of a presumed paralytic ileus (FALKENBURG, FRUND, SIEGEMANN and others) It is therefore easy to imagine the surgeons' surprise when the opening of the peritoneal cavity releases large quantities of odourless gas accompanied by audible wheezing or whistling Some surgeons (e. g. FRUND and BERGEMANN) thought they had opened the intestine, but a further inspection revealed the intestine collapsed posteriorly in the abdominal cavity The tapping of the gas as a rule has resulted in a considerable subjective relief and improvement of the general condition In case there has been no visible perforation, further interventions generally have proved unnecessary In rare cases only the accumulation of gas has recurred (URBAN BERGLMANN)

As far as I can see, the literature does not contain other reports in which the only treatment has consisted in tapping the gas by puncture The method must, however, be considered as fully warrantable in the case of debilitated patients, if the diagnosis has been established by X-ray and there is no evidence of the escape of gastric or intestinal contents into the peritoneal cavity (muscular rigidity) It is a gentle method of pulling the patient through the first critical stage, and afterwards the surgeon has time to search for the actual cause of the condition and arrange his therapy accordingly After the puncture the patient of course should be kept under careful observation for peritoneal symptoms

As a measure of guarding against peritonitis the patient under discussion received sulfathiazole intraperitoneally, intramuscularly, and perorally Most of the reported cases have recovered after the gas has been let out by laparotomy, but a few have had a fatal outcome The administration of sulfathiazole in this case probably was in part responsible for the uneventful course, considering that the somewhat purulent peritoneal fluid contained *Bacilli coli*

### Summary.

The author reports a case of pronounced pneumoperitoneum in a 68-year old man who at a subsequent operation exhibited a constricting cancer at the junction of the sigmoid flexure of the colon and the rectum The diagnosis was established by X-ray Primary recovery was obtained by evacuation of large amounts

of odourless gas by puncture of the abdomen and intraperitoneal injection of sulfathiazole which also was given intramuscularly and by mouth. Apart from gas the puncture also yielded a small amount of purulent peritoneal fluid, which on bacteriological examination revealed growth of *Bacilli coli* and a few Gram positive cocci. In this case the cause of the pneumoperitoneum is presumed to be the escape of gas through a small opening, acting as a valve in the sigmoid flexure or the tumour, without such opening, however, having been demonstrable.

### Zusammenfassung.

Es wird ein Fall von gut entwickeltem Pneumoperitoneum beschrieben bei einem 68-jährigen Manne, von dem sich bei späterer Operation herausstellte, dass er einen strukturierten Krebs am Übergange des Colon sigmoideum in das Rectum hatte. Die Diagnose wurde durch Röntgenuntersuchung gestellt. Er wurde primär geheilt durch Entleerung grosser Mengen von geruchloser Luft mittels Punktion der Bauchhöhle und Einspritzung in das Peritoneum von Sulfathiazol, das ausserdem intramuskulär und peroral gegeben wurde. Es wurde ferner eine geringe Menge leicht eitrige Peritonealflüssigkeit entleert, die bei bakteriologischer Untersuchung Wachstum von *Coli* und spärlich von grampositiven Kokken aufwies. Als Ursache des Pneumoperitoneums wird in diesem Falle angenommen, dass durch eine feine, als Ventil wirkende Öffnung im Colon sigmoideum oder im Tumor Luft hinausgepresst wurde. Solch eine Öffnung wurde jedoch nicht nachgewiesen.

### Résumé.

L'auteur rend compte d'un cas de pneumo-péritoine chez un homme de 68 ans, chez lequel on trouva, lors d'une opération ultérieure, une stricture d'origine cancéreuse entre le colon sigmoïde et le rectum. Le pneumo-péritoine fut diagnostiqué par radiographie. Guérison *per primam* après évacuation d'une quantité considérable d'air modérant après ponction de l'abdomen et injection dans le péritoine de sulfathiazol, qui fut en outre administré en injections intramusculaires et par voie buccale. Il y eut également évacuation d'une petite quantité de liquide louche qui, à l'examen bactériologique, donna des colonies de colibacille et

de coques prenant le Gram On suppose qu'il faut chercher la cause du pneumopéritoine à l'air piessé dans la cavité péritonéale à travers une minuscule perforation du colon ou de la tumeur obturée par un éperon faisant soupape Il ne fut cependant pas possible de démontrer l'existence de la perforation

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From Eira Hospital, Stockholm  
(Head physician G WILLNERS)

## Observations on the Cause and Social Significance of Ulcers of the Legs.

By

AKE NILZÉN

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This disease has been the subject of much attention during the last few years and the interest it has aroused is well warranted. As ROHOLM in Denmark has recently pointed out, it ranks as one of the chief diseases from which disablement results, causing losses to the Danish state directly and indirectly amounting in peace time, 1936, to about 2 million crowns a year. According to this observer, at least 5,000, possibly 10—15,000 cases occur every year in Denmark. In the clinical wards in Copenhagen more than 300 cases are hospitalized every year.

The old theories concerning the genesis of leg ulcers have been revised and new therapeutic possibilities have thereby been achieved. Ulcers of the legs are in most instances to be regarded as sequels of thrombosis in the deep veins of the leg. The recent treatment of early thrombosis with the specific anticoagulants, heparin and dicoumarol, therefore promises to be of value also for the prevention of the destructive processes in the venous system of the leg which follow advanced thrombosis and give rise to chronic indurations and ulcers.

In his textbook of 1939, HOMANS describes chronic leg indurations as the sequels of thrombophlebitic processes in the deep veins of the leg. In this country, BIRGER independently came to a similar conclusion in connection with a dermatologic study of 432 patients with *ulcus cruris* (BIRGER 1941). Deep venous thrombosis was mentioned in the past history in 33 per cent of the cases, and superficial phlebitis in another 26 per cent. BAUER, in 1942, found in 38 patients with non-specific leg ulcers, signs of previous thrombophlebitis in 87 per cent of them, as revealed through phlebographic X-ray examination of the deep veins.

From Ena Hospital, where a considerable number of patients with leg ulcers are treated, WILLNERS in 1941 reported on 73 cases, with thrombosis in the past history in 41 per cent of them. Since as early as 1920, the case histories contain mention of earlier thrombophlebitic attacks.

Because of the importance of this disease I have studied 111 patients with non-syphilitic and non-diabetic ulcers treated during 1943 and 1944 at Ena Hospital. Particular attention has been paid to the previous history, the duration of the hospital stay, and to the age of the patients.

### The Previous History.

The occurrence of thrombosis earlier in the history was verified by studying the hospital records. The material could thus be divided into three groups, 1) patients with proved thrombosis, 2) patients who said that they had thrombosis, 3) patients with no thrombosis (See table I.)

Table I

*Previous thrombosis of the legs in 111 patients with leg ulcers*

	Proved deep venous thrombosis	Uncertain venous thrombosis	No thrombosis	No records
Males	9	4	9	2
Females	37	13	32	5
%	11.1	15.4	36.9	6.4

Thus, thrombosis could be said to have occurred in at least 41 per cent of the cases and possibly in another 15 per cent.

Among 43 patients, the thrombosis followed *parturition* in 18, *operation* in 12, *trauma* in 6, and in 7 other influences had been in question.

Table II

*The stay in hospital necessitated by leg ulcers*

Time (in months)	Post thrombotic ulcers	Uncertain post thrombotic ulcers	No post thrombotic ulcers
1	30	7	23
2	13	5	13
3	1	3	3
4	1	—	1
5	—	2	—
6	1	—	1

The stay in hospital was surprisingly short, one or two months, in most of the cases (See table II) Some of them, however, were not cured when dismissed and others returned to the hospital two or three times Table III shows how many times the individual patients received treatment at the hospital

Table III.

*Number of treatments at the hospital*

Times in hospital	Post thrombotic patients	Uncertain post thrombotic patients	Non-thrombotic patients
1	18	8	22
2	17	2	10
3	3	1	6
4	2	1	1
5	2	—	—
5	4	5	2

As may be seen from table III, a considerable number of the patients, among the *post-thrombotic patients every second one, had to return once more to the hospital* An error has arisen according to the fact that not all the patients could be accepted at the wards

Table IV.

*Time elapsing before recurrence*

	In patients with post- thrombotic leg ulcers	In patients with no post- thrombotic leg ulcers
1 week	1	—
2 weeks	2	2
2 months	4	3
6 "	1	1
6—12 "	1	—
1 year	7	5

*Less than half of the number of patients with a recurrence remained in good condition for one year*

The age of the patients with *ulcus cruris* is shown in table V The disease was most common in patients between 30 and 60 years of age and was thus not confined to the highest age groups

The time elapsing between the thrombotic attack and the outbreak of ulcers in the legs is shown in table VI

Among 43 cases with proved deep venous thrombosis of the leg, leg ulcers developed within one year after the thrombotic attack in 18, within five years in 32, and in 3 of them they did not appear until 16 to 20 years later

Table V.

*Age at which ulcer cruris appeared*

Age	Males	Females
10—14	—	1
15—19	1	—
20—24	2	2
25—29	—	5
30—34	2	9
35—39	3	11
40—44	2	13
45—49	1	8
50—54	2	10
55—59	3	11
60—64	—	10
65—69	—	6
70—89	3	6

Table VI.

*Time elapsing between thrombosis and appearance of leg ulcers*

Year	0—1	2—5	6—10	11—15	16—20
No of cases	18	14	4	4	3

## DISCUSSION

The number of patients in Sweden suffering from ulcers of the legs is not known. It is estimated by BAUER at about 30,000. The figures for Denmark, quoted by ROHOLM, are thus evidently applicable to other countries. The disablement caused by this disease is difficult to register, however, since the persons afflicted are mostly women engaged in housework.

Furthermore, the destruction of the deep veins of the leg which lies at the foot of the morbid condition prevents the application of the ordinary treatment of varicose veins and ulcers by injections. As has been pointed out by SVEND HANSEN in 1937, and by BIRGER, BAUER, and WESTERBORN, injection therapy for the superficial varicose veins is out of the question if the deep veins have ceased to function. Unfortunately, this rule is not always followed.

If no phlebographic examinations can be made the diagnosis can be difficult. In such a situation Perthe's sign may offer some help. A rubber tube is fixed around the calf below the knee. If the deep veins are patent, the superficial vessels will empty when the patient starts walking.

### Summary.

One hundred and eleven patients with leg ulcers, treated at Era Hospital, Stockholm, during 1943--44, were studied from the standpoints of the cause of the ulcers, the length of the hospital stay, recurrences, the age of the patients, and the time elapsing between the thrombotic attack and the appearance of the ulcers

In 41 per cent of the patients thrombosis was mentioned in the history and in another 15 per cent this disease might have been present

The stay in hospital lasted 1--2 months

Fifty per cent of the post-thrombotic cases had a recurrence of the leg ulcers, in about one in every two of them they developed within one year

The patients were not particularly old, almost all of them being between 30 and 60 years of age

Out of 43 patients with thrombosis, 18 had leg ulcers within one year and 32 within five years

The possibility of lessening the disablement caused by leg ulcers is discussed Chief interest is attached to the early treatment of thrombosis of the legs with heparin, whereby a destruction of the whole deep venous system can be prevented

### Zusammenfassung.

An 111 Patienten, die in den Jahren 1943--1944 im Krankenhaus Era in Stockholm behandelt wurden, wurden Untersuchungen angestellt in bezug auf die Krankheitsursache, die Dauer des Krankenhausaufenthalts, die Rezidive, das Alter der Kranken und die von der Thrombose bis zum Auftreten des Ulcus cruris verfllossene Zeit

Bei 41 % der Kranken war die Thrombose in der Anamnese erwähnt, und bei weiteren 15 % ist es möglich, das diese Krankheit vorgelegen hatte

Der Krankenhausaufenthalt dauerte 1--2 Monate

50 % der postthrombotischen Fälle bekamen Rezidive und zwar etwa die Hälfte vor Ablauf eines Jahres

Die Kranken waren nicht besonders alt Fast alle standen im Alter von 30--60 Jahren

Von 43 Kranken mit Thrombose bekamen 18 innerhalb eines Jahres Ulcus cruris und 32 innerhalb von fünf Jahren

Es wird die Möglichkeit erörtert, die durch Ulcus cruris verursachten Schädigungen zu vermindern. Das Hauptgewicht wird auf eine frühzeitige Heparinbehandlung von Thrombosen gelegt, wodurch sich eine Zerstörung des gesamten tiefen Venensystems verhindern lässt.

### Résumé.

L'auteur rapporte des recherches faites à propos de 111 malades affectés d'ulcus cruris traités à l'hôpital Eira à Stockholm en 1943—44 et portant sur la cause de l'affection, la longueur du séjour hospitalier, les récurrences, l'âge des malades et l'intervalle existant entre la thrombose et l'apparition de l'ulcère.

Chez 41 % des malades la thrombose était mentionnée dans l'anamnèse, pour un autre groupe de 15 % on peut admettre la possibilité de la thrombose.

Durée du séjour hospitalier 1—2 mois.

Récidive dans 50 % des cas où l'ulcère était la conséquence d'une thrombose, dans la moitié des cas la récidive se produisit au cours de l'année qui suivit la guérison.

Les malades n'étaient pas particulièrement âgés pour la plupart entre 30—60 ans.

Dans 43 cas de thrombose, l'ulcère suivit dans 18 cas au cours d'un an et dans 32 entre la deuxième et la sixième année.

L'auteur discute la possibilité de remédier aux dommages que cause l'ulcus cruris. Il accorde la plus grande importance au traitement précoce des thromboses par l'héparine qui empêche la destruction de tout le système veineux profond.

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## L'ulcère Peptique du Diverticule de Meckel.

Par

JØRGEN LUND

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Comme on le sait, le diverticule de Meckel peut donner lieu à une série d'états morbides dont la plupart sont connus et décrits depuis de longues années. Au contraire, l'affection diverticulaire en question n'est reconnue pour une unité clinique que depuis relativement peu d'années, et elle n'a pas fait l'objet d'une mention d'ensemble dans la littérature scandinave pendant la dernière décade. Aussi donnerai-je, sur la base de 4 cas inédits et des publications accessibles discutant cette maladie, un exposé de sa clinique, de son diagnostic, et de sa thérapeutique. Ceci d'autant plus qu'elle semble être moins rare qu'on ne le considère en général.

On sait que la présence du diverticule de Meckel est de 1 à 2 %, plus fréquente chez l'homme que chez la femme, et qu'il constitue le dernier reste — insuffisamment oblitéré — du canal omphalo-mésentérique foetal. Il est composé des mêmes couches que l'iléon, et sa muqueuse correspond en général à la muqueuse de type intestinal grêle revêtant l'iléon. Cependant, depuis les expériences de KOCH en 1915 et surtout grâce aux travaux de SCHÄETZ (1925) on n'ignore plus le fait que dans beaucoup de cas la face interne du diverticule est tapissée, dans une mesure plus ou moins large, de muqueuse gastrique entièrement ou fortement semblable à la muqueuse fundique normale. De nouveaux chercheurs (HUDSON & KOPLIK, HUDSON) ont constaté de la muqueuse gastrique dans plus de 50 % des cas examinés (matériaux d'autopsie).

La présence de muqueuse gastrique hétérotopique dans d'autres parties d'un canal omphalo-mésentérique, persistant entièrement

ou en partie, a été connue depuis l'observation en 1883, par TILLMANNS d'une tumeur ombilicale sécrétant du suc gastrique, et dont la muqueuse ressemblait tout à fait à la muqueuse fundique normale. Plus tard, des observations semblables ont été communiquées à plusieurs reprises, et différentes théories sur l'origine de ces épithéliums anormaux ont été formulées, la plus vraisemblable en semble être celle proposée par SCHAEZT, selon laquelle l'hétérotopie serait due à une auto-implantation foetale de cellules épithéliales gastriques.

Avant de passer à une mention ultérieure de l'affection, je vais rapporter 4 cas inédits,<sup>1</sup> observés pendant les dernières années.

*Observation I* Un garçon de 2 ans, admis au service de chirurgie de St Elisabeths Hospital, en juin 1944, avait commencé, douze heures avant l'hospitalisation, à se plaindre de douleurs et d'élançements au bas-ventre, et en même temps il était mal à l'aise et fatigué. Il était possible que l'enfant eût avalé une épingle peu de temps avant. Six heures avant l'admission survinrent quelques vomissements alimentaires et, quelques heures après, de fortes coliques abdominales, sur quoi l'enfant fut transporté à l'hôpital. Par ailleurs on apprend, par voie anamnétique, qu'après la naissance de l'enfant on avait remarqué que la chute du cordon ombilical ne se produisait que quinze jours après l'accouchement, et que, pendant une assez longue période, une petite suppuration restait près de l'ombilic. En outre le garçon avait, pendant les six premiers mois de sa vie, une petite hernie ombilicale. Les parents de l'enfant n'ont jamais, avant le présent cas, observé aucune présence de melaena ni de sang dans les matières fécales.

À l'admission, l'enfant est très anémique, et l'examen rectal révèle du sang neuf dans l'ampoule du rectum. L'examen ultérieur ne montre rien d'anormal. L'examen radiologique ne révèle aucun signe d'invagination ni de corps étrangers produisant des ombres. Pourtant, l'état du malade change complètement au cours des dix heures suivantes, étant donné que la température, normale à l'admission, s'élève à 38° 6, et l'état général est mauvais avec sécheresse de la langue. L'abdomen est assez dilaté et ballonne avec rigidité sous-ombilicale, également dans les fosses iliaques droite et gauche. En face de ces faits, on compte sur la possibilité d'un diverticule de Meckel perforé, en tout cas d'une perforation en péritoine libre, et après une transfusion de sang on procède à la laparotomie. On constate ainsi immédiatement la présence d'une quantité de sang dans la cavité péritonéale, et d'une façon générale le péritoine est légèrement injecté. On trouve vite sur l'iléon un diverticule de Meckel long de 2 cm, ayant à sa base une perforation

<sup>1</sup> Je tiens à adresser mes plus vifs remerciements au professeur H. ABRAHAMSEN, et au chirurgien en chef HANS WULF, dont l'obligeance m'a permis de faire reproduire ici les cas observés respectivement au service D, de Bispebjerg Hospital, et au service H, de Gentofte Amtssygehus.

grosse comme un grain de millet Le diverticule n'offrant aucun signe macroscopique d'inflammation est extirpé, et la paroi abdominale est refermée

Les premiers jours après l'opération, le malade est un peu faible, mais grâce au traitement de vasopressine, de prostigmin, de transfusions sanguines, et d'injections, d'eau salée on réussit à le sauver Il quitte l'hôpital en bonne santé quinze jours après l'opération

L'examen histologique du diverticule enlevé montre que l'architecture de la muqueuse est à peu près identique à celle du corpus ventriculi De la sous-muqueuse infiltrée à de grandes masses de leucocytes et de lymphocytes, de la sous-séreuse avec des infiltrations diffuses de sang Il se trouve un orifice de perforation à la base du diverticule

*Obs II* Garçon de 16 ans et 9 mois, admis au service de chirurgie H, de Gentofte Amtssygehus, en février 1943 Vingt-quatre heures auparavant il avait eu une crise aiguë de douleurs abdominales diffuses et persistantes Le soir et la nuit avant l'admission il avait quatre vomissements au total Le matin, au jour de l'admission, les douleurs sont surtout localisées à la fosse iliaque droite et sont moins violentes Dernières selles vingt-quatre heures avant l'entrée à l'hôpital, aucune évacuation de gaz ne s'est produite après Pendant les six derniers mois précédant le présent cas, le malade a eu, par périodes, des oppressions épigastriques se manifestant quelques heures après les repas Jamais nausées ni vomissements

À l'admission, le malade a 37° 8 de température et le pouls bat à 100 La région inférieure de l'abdomen est dilatée, et il y a de la sensibilité intense partout, surtout au-dessus de la symphyse et à la fosse iliaque droite Le toucher rectal montre de la sensibilité en haut et à droite Dès l'admission on pratique la laparotomie (évidemment avec le diagnostic d'appendicite), dans le péritoine on trouve un peu de pus rougeâtre et beaucoup de liquide séro-purulent, l'appendice, qui a l'aspect naturel, est enlevé À 50 cm on amont de l'intestin grêle, on constate la présence d'un diverticule de Meckel, étroitement soude au mésentère Le diverticule est dégagé et extirpé

À l'examen microscopique il se trouvait contenir de la muqueuse fundique en îlots, ainsi qu'un ulcère ressemblant à un ulcère duodénal L'orifice même de la perforation n'était pas visible

Marche post-opératoire sans complications

*Obs III* Un garçon de 13 ans est amené au service de chirurgie D, de Bispebjerg Hospital, en novembre 1938 Vingt-quatre heures auparavant, des douleurs abdominales diffuses sont survenues assez brusquement, les douleurs étant le plus violentes dans la région droite Nausées et vomissements Les douleurs ont diminué la nuit avant l'admission pour redevenir violentes au matin, où les vomissements ont recommencé Ni évacuation de matières ni de gaz pendant les 4 à 5 dernières heures avant l'entrée à l'hôpital Auparavant il y a eu nombre d'accès pareils On n'a pas de renseignements sur l'existence éventuelle de melaena ni d'hémorragies anales

À l'admission, le malade est un peu pâle, mais l'état général est

assez satisfaisant Température 38°, pouls 96 L'abdomen est rétracté en forme de bateau avec rigidité universelle et sensibilité surtout dans la région du bas-ventre et dans les deux côtes Par ailleurs, l'examen ne montre rien d'anormal, abstraction faite d'une légère sensibilité au toucher rectal On pratique immédiatement la laparotomie qui révèle une péritonite diffuse explicite avec abondance de pus et de fibrine L'appendice est légèrement injecté, il se trouve de 30 à 40 cm en amont de l'iléon, un diverticule de Meckel gros comme l'extrémité du pouce, à la base du diverticule on aperçoit une perforation grosse comme un pois d'un ulcère calleux Comme les altérations calleuses s'étendent un peu sur l'intestin grêle, et comme le diverticule a en outre une base large, on introduit une sonde de Nélaton dans l'orifice de la perforation en la fixant avec 2 sutures en bourse Le diverticule est fixé au péritome pariétal et à la peau avec des points séparés de soie La marche post-opératoire est, grâce au traitement de streptasol, sans complications, la sonde est enlevée le sixième jour, après quoi la plaie se ferme vite, et la patient quitte l'hôpital en bon état

Le garçon, qui n'avait éprouvé aucun symptôme pendant un an, fut ensuite pendant quelques mois pris de douleurs se manifestant capricieusement dans l'épigastre Les douleurs survenaient sans relation avec les repas et sans que l'alimentation soulage, ni nausées ni vomissements Après une période où il était relativement peu gêné, survint subitement une violente crise de melaena en septembre 1940, sur quoi il fut transporté au service de médecine B, de Bispebjerg Hospital Là on ne constate aucun signe d'affection stomacale, de même que l'examen radiologique de l'estomac et de l'intestin ne révèle rien d'anormal Donc, on attribua l'hémorragie au diverticule laïssé, et le malade fut transporté au service de chirurgie D, pour être opéré

On fit l'ablation du diverticule adhérent à la paroi antérieure de l'abdomen, l'examen microscopique révéla de la muqueuse fundique

Guérison

*Obs IV* Garçon de 6 ans, amené au service de chirurgie D, de Bispebjerg Hospital, en avril 1940 Jusque-là d'excellente santé La nuit avant l'admission, qui eut lieu à 11 heures du matin, l'enfant est subitement pris de douleurs abdominales diffuses et persistantes Une ou deux fois des régurgitations faibles mais aucun vomissement réel L'aspect des selles n'a pas été observé par la mère de l'enfant, ni à présent ni auparavant, on est sans renseignements sur l'évacuation éventuelle de gaz

A l'admission, l'enfant est très déprimé, température 37° 8, le pouls bat à 88 Forte sensibilité et rigidité dans tout l'abdomen, surtout dans la fosse iliaque droite Par ailleurs rien d'anormal n'est constaté On pratique immédiatement la laparotomie qui révèle beaucoup de liquide louche dans la cavité péritoneale L'appendice, qui est rouge et oedémateux, est enlevé En outre, on trouve un diverticule de Meckel gros comme une noix et à base large, sur laquelle se trouve une perforation de la grosseur d'un grain de poivre La base large nécessite une résection intestinale (4 cm) avec anastomose termino-terminale

Le diverticule enlevé s'avère contenir de la muqueuse du type fundique. La perforation siège à la jonction des muqueuses gastrique et intestinale sur le diverticule.

Marche post-opératoire sans complications.

Comme on le verra plus tard, ces cas sont des exemples typiques des différentes formes que peut prendre l'affection. Ici l'on voit d'une part les cas se déclarant par des hémorragies, où il est facile de se rendre compte du mal, et d'autre part les cas débutant comme une catastrophe abdominale aiguë, cas où seuls l'enquête et l'examen détaillés des malades peuvent renseigner sur la nature de l'affection.

Il est mentionné plus haut que l'ulcère peptique du diverticule de Meckel n'existe comme unité nosologique que depuis quelques années. De grands exposés monographiques, parus entre 1910 et 1920, sur les affections diverticulaires, ne disent rien sur ladite affection (MEYER, WELLINGTON). DEETZ trouve le premier de la muqueuse gastrique dans un diverticule de Meckel, mais cette coïncidence est considérée comme fortuite (1907). HUBSCHMANN (1913) attire le premier l'attention sur la muqueuse gastrique comme facteur pathogénique décisif dans l'apparition de ces ulcérations. De Scandinavie, le premier cas communiqué est celui de KARL GRAMÉN, en 1915, qui se rendait entièrement compte du fait que l'ulcère était analogue, à tous égards, aux ulcères ordinaires de l'estomac et du duodénum. La même année que GRAMÉN, CALLENDER relate d'Amérique le cas d'un enfant, mort par suite d'une entérorragie pour la même raison, sans qu'on se fût rendu compte de la cause du saignement, et sans qu'une opération ait été tentée. Les années suivantes, certains cas sont rapportés, surtout de France et d'Allemagne, et sur la base des quelques rares histoires cliniques connues alors, HUBERT donne, en 1924, un aperçu monographique dans lequel il s'applique surtout à élucider la clinique.

Le diagnostic pré-opératoire fut posé pour la première fois en 1927 (voir A. S. JACKSON). Après cette date, un nombre toujours croissant de cas sont publiés annuellement, et dans la littérature accessible, y compris les observations rapportées ici, il se trouve à l'heure actuelle un total de 136 sujets atteints de l'affection. Au Danemark l'affection fut observée pour la première fois par MEULENGRACHT (1918). Des contributions casuistiques furent fournies par ULRICH (1925), KLINDT et NIELSEN (1934), HENRIKSEN (1936), HARILD (1938), et STAMER (1939), en outre,

AALKJÆR donna un bref aperçu sur le sujet en 1937 C'est surtout pendant les huit à dix dernières années, après qu'on a compris les points essentiels de l'affection, que la littérature augmente de volume, et il faut souligner *qu'à l'heure actuelle l'affection est loin d'être rare* Cela est confirmé par le fait qu'en passant en revue les matériaux de trois services de chirurgie de Copenhague et environs, matériaux datant des cinq ou six dernières années, on y trouva 4 cas

*Chez les enfants au-dessous de 10 ans, l'ulcère du diverticule de Meckel semble être en somme la cause la plus fréquente des entérorragies*, et puisque l'intervention chirurgicale peut signifier un sauvetage, il est extrêmement important, le cas échéant, de penser au diverticule

Comme introduction à un aperçu sur la clinique de la maladie, je vais d'abord en étudier l'anatomo-pathologie et la pathogenie

Dans les cas non perforés on ne trouve en général, à l'ouverture du péritoine, rien d'intéressant, abstraction faite du diverticule même, qui dans ces cas est un peu calleux et infiltré, éventuellement imbibé de sang, tandis que l'ulcération même n'est pas palpable Parfois on voit par transparence la partie distale de l'ileon et du côlon gorgée de sang bleuâtre (MEGEVAND & DUNANT, STONE, WINKELBAUER, BRASSER, HUARD)

La perforation se produit le plus souvent en péritoine libre, ce qui cause une péritonite diffuse poussant vite et ne diffèrent pas, au point de vue anatomique, des autres péritonites par perforation Pourtant, il est beaucoup plus fréquent dans ces perforations que dans les ulcères gastro-duodénaux perforés, que l'orifice de la perforation soit obstrué momentanément par des amas épiploïques ou des anses intestinales couvrant l'ouverture Sans doute il est rarement question d'une véritable pénétration, mais qu'il s'agisse d'une perforation obstruée ou d'une pénétration, il se forme ainsi de grandes agglomérations épiploïques et intestinales ou des abcès localisés (TREPLIN, v HABERER et d'autres) DEBRÉ, BOPPE & SEMELAIGNE relatent une observation extraordinaire d'une fistule allant d'un diverticule de Meckel au côlon transverse

En coupant le diverticule, on constate déjà à l'examen macroscopique la présence de muqueuse gastrique, étant donné que, sur une échelle plus ou moins vaste, la muqueuse normale est remplacée, en des régions nettement limitées, par une muqueuse plus épaisse et plus plissée, quelquefois mamelonnée comme celle

de l'estomac Les ulcérations mêmes rappellent celles de l'estomac et du duodénum, mais le plus souvent elles ne dépassent qu'un peu la grosseur d'une graine de chanvre, elles sont presque toujours solitaires La localisation est la base du diverticule, et chose caractéristique, juste à la jonction des deux formes de muqueuse Dans quelques cas on a trouvé l'ulcère dans l'intestin grêle même, à quelques centimètres du diverticule (ASCHNER & KARELITZ, COBB I, DRAGSTEDT, FELLOWS, HARTGLASS, HUDSON), il n'est donc pas étonnant que parfois on n'ait pas réussi, au cours de l'opération, à trouver l'agent causal du saignement sous la forme d'un ulcère du diverticule de Meckel Il est aussi facile à comprendre que l'extirpation du diverticule avec la muqueuse gastrique sécrétante doit causer la cicatrisation de l'ulcère

L'examen microscopique révèle une muqueuse partie du type de la muqueuse iléale ordinaire et partie de l'aspect du fundus ventriculi, c'est-à-dire des acini munis tant de cellules principales que de cellules bordantes La quantité de muqueuse fundique varie beaucoup, allant de petits îlots jusqu'à un revêtement entier de cette forme de muqueuse (SCHAEZT) Ainsi, sans une coupe en série, on peut très facilement ne pas découvrir l'hétérotopie, en effet elle a passé inaperçue dans un certain nombre de cas, où il existait un ulcère typique Dans presque tous les cas que nous venons de mentionner, où l'ulcère siégeait dans l'intestin grêle même, le diverticule entier était tapissé de muqueuse stomacale, cela souligne encore le fait que l'ulcère ne se trouve pas dans la muqueuse stomacale mais dans la muqueuse adjacente de l'intestin grêle (comp les ulcères peptiques jéjunaux)

Quant au cours spontané de ces ulcérations, il faut dire que la tendance à cicatrisation est minime Un ulcère en voie de cicatrisation n'a été observé qu'une seule fois (PASCALE) Le cours en est chronique avec tendance à saignement et à perforation

La question de la pathogénie de ces ulcérations se relie étroitement en effet à la question contestée de la genèse de l'ulcère en général, fait que je n'examinerai pas de plus près Pourtant il faut d'abord établir comme certain qu'il y a sécrétion de la muqueuse hétérotopique, et que celle-ci est identique à la sécrétion gastrique normale (TREPLIN, SCHAFF) Il faut ensuite insister sur le fait que la présence de cette localisation de l'ulcère favorise beaucoup la conception suivant laquelle l'effet peptique de la sécrétion gastrique serait, d'une façon générale, le facteur pathogénique décisif dans la genèse de l'ulcère On ne s'imaginerait pas facilement

ici des effets nocifs exogènes comme présumés par KONJETZNY et son école, dans la genèse d'une gastrite pré-ulcéreuse. Les résultats expérimentaux aboutissent à une constatation du même ordre, par ex les expériences connues de MATTHEWS & DRAGSTEDT, où ils étaient à même, dans 100 % des cas, de produire chez des chiens des ulcérations peptiques dans l'iléon, par l'implantation d'un estomac en miniature de PAVLOW dans les anses iléales fermées. Pendant ces dernières années, WU & THOMSON ont en outre élargi ces expériences en mettant en évidence une sensibilité croissante, du duodenum à l'iléon, à la sécrétion gastrique.

*Essai clinique* Ce qui frappe tout d'abord en observant les malades, c'est qu'il s'agit presque exclusivement de garçons (ou d'hommes). Sur 128 observations, avec indication de sexe, 107 fois il s'agissait de malades du sexe masculin, c'est-à-dire environ 82 %.

Mentionnons encore que la répartition suivant l'âge est tout à fait caractéristique, ce qui ressort du tableau ci-dessous.

Au-dessous de cinq ans	55 malades
De cinq à dix ans	31 »
De dix à quinze ans	10 »
De quinze à vingt ans	14 »
Au-dessus de vingt ans	14 »
<hr/>	
Total 124	»

Ainsi donc, plus de la moitié des malades avait moins de 10 ans, environ 80 % moins de 15 ans, et environ 90 % moins de 20 ans. Le plus âgé des malades avait 53 ans (McKEEN), et le plus jeune 3 mois, chez cet enfant on aurait observé du melaena déjà 2 jours après la naissance, melaena récidivant périodiquement jusqu'à la mort de l'enfant, à l'âge de 3 mois (MOLL).

Le plus souvent l'occasion d'entrer en contact avec les malades ne se présente que dans une poussée aiguë de la maladie, dans de tels cas le caractère brusque de la maladie, soit à cause d'une hémorragie ou à cause de la perforation de l'ulcère, les deux phénomènes étant éventuellement survenus à peu près simultanément, impose des soins médicaux. Cependant, il ressort de la littérature, quoique d'une manière moins évidente quant aux cas publiés ici, que chez un grand nombre de malades l'affection s'est manifestée déjà pendant une assez longue période, de sorte

qu'en vérité la marche en a été chronique avec des exacerbations aiguës. La question de savoir jusqu'à quel point et quand il est possible de repérer le début de l'affection, dépendra de beaucoup de la manière dont les malades sont interrogés, les symptômes subjectifs étant souvent extrêmement vagues.

La plainte principale porte sur les douleurs qui, par les grands enfants et par les adultes, sont caractérisées comme faibles, vagues, souvent persistantes, mais de temps en temps semblables à des coliques (voir p. ex. MONDOR & LAMY, ROUDIL & MARTY). La localisation change avec les malades, mais le plus souvent les douleurs siègent au-dessous de l'ombilic, dans la région supérieure de la fosse iliaque gauche ou droite. La localisation à la région inférieure de l'épigastre n'est pourtant pas rare (p. ex. notre observation II). Les douleurs se déclarent à intervalles irréguliers, le plus souvent dans la journée, on a pourtant constaté chez un nombre de malade adultes, une connexité assez nette avec l'ingestion des aliments, de sorte que les douleurs se manifestent d'un quart d'heure à une demi-heure après les repas (DETON, KLEINSCHMIDT Obs. II). Une telle présence tardive occasionnelle des douleurs ne paraît pas étonnante vu le synchronisme de la sécrétion diverticulaire et de l'ingestion des aliments. Chose plus singulière c'est que de temps à autre il peut se produire un soulagement par les aliments ou par les alcalins (COBB I).

Comme dans les ulcères gastro-duodénaux, il existe ici aussi une périodicité plus ou moins nette dans la présence des symptômes. Les intervalles libres sont plus ou moins longs, le plus souvent d'une durée de quelques mois, mais assez souvent les malades restent sans symptômes pendant des années.

Ainsi qu'il ressort de ce qui précède, on ne saurait aucunement poser de diagnostic par le caractère ni par la localisation des douleurs. Mais, le plus souvent, les douleurs sont accompagnées de l'autre signe important. L'hémorragie anale. Cette hémorragie a deux caractéristiques principales. Elle survient par accès, et elle est profuse. Il en est de même pour la présence et la fréquence des accès hémorragiques que pour la présence des douleurs. Des intervalles sans saignement pendant quelques mois — chez les jeunes enfants les intervalles sont plus courts — interrompus par des hémorragies courtes mais souvent violentes. Assez souvent il y a chez les grands enfants et les jeunes gens des intervalles sans saignement durant des années. MEGEVAND & DUNANT mentionnent le cas d'un malade n'ayant pas eu d'hémorragies entre 5 et 25 ans,

un cas semblable a été observé par CHESTERMANN Les symptômes peuvent débiter à une époque quelconque au-deça des classes d'âge dans lesquelles la maladie se manifeste On a observé des hémorragies provenant d'un diverticule de Meckel chez un enfant de 2 jours, tandis que KLEINSCHMIDT rapporte un cas où celles-ci apparaissaient pour la première fois chez un sujet âgé de 45 ans

Il n'existe pas de rapports sûrs entre l'hémorragie et la douleur, bien qu'elles s'accompagnent naturellement souvent Pourtant, on voit fréquemment chez les malades, qui pendant une assez longue période ont eu des douleurs intermittentes sans aucun saignement, celui-ci survenir dans un intervalle sans douleurs Des hémorragies sans douleurs ont été observées dans 10 à 12 cas

Il est déjà mentionné comme typique que le sang apparaît d'abord en grandes quantités mélangé aux matières fécales et ensuite comme sang pur souvent liquide, clair ou noir, accompagné de caillots Ceux-ci peuvent apparaître seuls, mais il semble que l'évacuation par le rectum de sang liquide mélangé de caillots soit particulièrement caractéristique En outre, il faut signaler qu'il n'y a pas mélange de mucus au sang L'évacuation de sang non mélangé débute quelquefois par des melaenas (BURGER), il arrive pourtant plus souvent que le saignement se termine en melaenas (CARD & MINNPRISS, EDWARDS, HARILD, TAVERNIER & GUILLEMENT) Dans quelques cas des hémorragies se manifestant uniquement sous forme de melaenas ont été observées (p ex notre cas III)

L'anémie aigue et souvent grave est le corollaire de l'hémorragie, l'évanouissement pendant l'hémorragie n'est pas rare La mort par hémorragie n'a été observée qu'une seule fois (CALLENDER), mais beaucoup de cas n'ont été sauvés que grâce à une intervention chirurgicale immédiate Pendant l'hémorragie même il survient souvent un ou deux vomissements, phénomène qu'on observe surtout chez les petits enfants, par contre, dans l'hémorragie sans complications, on ne constate pas de vomissements persistants, ceux-ci devant faire soupçonner une perforation imminente THOMSON signale la présence, en même temps que l'hémorragie, d'une faible élévation de température chez les enfants, cela ne semble pas être exact, étant donné qu'il y a plutôt une tendance vers la température au-dessous de la normale («shock») Il est très important de se rendre compte du fait que le moindre soupçon de fièvre pendant l'hémorragie est un sérieux indice de la possibilité d'une perforation imminente

D'autres types de saignement apparaissent par exception AAL-KJÆR et DRAGSTEDT ont assisté à des saignements occultes chez trois malades, la question de savoir s'il se produit des saignements occultes dans les intervalles entre les saignements aigus n'est pas encore élucidée, bien qu'elle soit d'un intérêt capital, tant au point de vue diagnostique que thérapeutique

L'examen clinique de ces cas sans perforation ne donne en général que peu de renseignements, sauf qu'on peut constater la présence éventuelle de saignement et par là d'une anémie ainsi provoquée La teneur en hémoglobine s'avère être souvent considérablement diminué, étant donné que l'hémorragie a toujours existée quelque temps avant hospitalisation Elle se trouve d'une manière particulièrement constante entre 40 et 50 %, mais dans quelques cas l'examen du sang n'a monté que 12 p 100 d'hémoglobine (A S JACKSON) La sensibilité abdominale se manifeste rarement, de temps à autre des intumescences palpables ont été constatées (HILGENREINER, v HABERER, TISSDALL) Le toucher rectal ne montre rien d'anormal, abstraction faite d'une présence éventuelle de sang dans l'ampoule du rectum Un assez grand nombre de malades ont été opérés à ce stade de l'affection, et tous ont guéri

Cependant, beaucoup de cas n'ont été constatés qu'au moment où la perforation est survenue, et alors la chance de guérison est considérablement réduite Des cas connus, 59 % étaient compliqués de perforation, le diverticule de Meckel montre ainsi une tendance beaucoup plus nette vers la perforation que les ulcères gastro-duodénaux

Au point de vue clinique, il existe aussi de grandes différences entre la perforation des deux espèces d'ulcères, on peut dire que la perforation du diverticule de Meckel n'a pas, comme la perforation gastro-duodénale, le caractère d'une «abdominal catastrophe» Cela est dû au fait que le contenu intestinal soit du diverticule de Meckel en petites quantités activées par les mouvements péristaltiques rythmiques de l'intestin, il ne sort pas comme un grand jet de liquide acide comme celui de l'estomac

Chez les malades ayant éprouvé auparavant des douleurs chroniques intermittentes, la perforation se déclare souvent, ce qui est bien naturel, dans une telle période de douleurs Un beau jour les douleurs deviennent, plus ou moins subitement, assez violentes, quelquefois semblables à des coliques Des vomissements d'un caractère plus persistant viennent s'y joindre en indiquant

le début de l'irritation péritonéale. Peu à peu les douleurs, jusque-là localisées au-dessous de l'ombilic, commencent à s'étendre à des régions plus vastes de l'abdomen. En même temps on observe une élévation de la température, sans que les malades aient éprouvé l'état de shock si caractéristique de l'ulcère gastrique perforé.

S'il y a eu auparavant, dans l'anamnèse, des hémorragies, la perforation apparaît, dans la grande majorité des cas, comme corollaire d'une telle hémorragie violente, seulement chez trois malades, ayant eu des hémorragies, la perforation se manifestait dans un intervalle sans hémorragies. *Par conséquent il faut considérer l'hémorragie comme un signe d'alarme sérieux indiquant l'imminence de la perforation.*

Un assez grand nombre d'ulcères sont perforés, sans que l'affection se soit aucunement manifestée auparavant (voir les présents cas III et IV, VAUGHAN & SIGNER, JOHNSTON et RENNER). Dans de tels cas on ne pourrait sans doute poser de diagnostic plus précis que celui de péritonite par perforation, pour la thérapeutique cela ne joue pour ainsi dire aucun rôle, pourvu qu'on se souvienne, à la laparotomie suivante, de l'existence éventuelle d'un diverticule de Meckel, et qu'on l'enlève le cas échéant.

Les cas avec perforation ont au début une faible élévation de température. Il y a forte sensibilité et rigidité dans la région sous-ombilicale de l'abdomen, dans certains cas, on constate que le maximum de sensibilité et de rigidité siège dans la ligne médiane ou, un peu à gauche de celle-ci, dans la fosse iliaque gauche. Pendant la marche ultérieure l'aspect abdominal ne diffère pas de l'aspect ordinaire dans la péritonite par perforation, il semble seulement que l'évolution vers ce stade soit plus rapide que par exemple dans la péritonite appendiculaire. Mais, comme je l'ai dit, le diagnostic est difficile à établir, et de nombreux cas ont été méconnus. Même sur la table opératoire la vraie cause de l'affection a été, dans de tels cas, négligée entraînant des conséquences fatales (BRASSER, WINKELBAUER, HUMBERT).

Comme déjà mentionné au sujet de l'anatomie pathologique, il n'est pas rare que l'orifice de la perforation soit trouvé bouché par les organes voisins, de sorte qu'il n'en résulte qu'une péritonite localisée, un abcès. De telles observations ont été rapportées par SHANNON, GRIFFITH, et MOSELEY. Dans ces cas, sensibilité et rigidité sont le plus souvent peu prononcées, et quelquefois elles font totalement défaut (MOSELEY), mais l'élévation de la tempéra-

ture est constatée dans tous les cas publiés, et il est très important de prendre garde à la présence de ce symptôme dans une hémorragie apparemment sans complications

Il est facile à comprendre que le diagnostic et le diagnostic différentiel de l'affection peuvent causer bien des difficultés, mais souvent, et avec une fréquence croissante pendant les dernières années, on a pourtant réussi à poser un diagnostic pré-opératoire. C'est partiellement grâce à la connaissance plus vaste de la clinique de l'affection, mais surtout au fait qu'on s'attend à sa présence. Parmi les observations publiées, le diagnostic est posé avant l'opération chez 33 des 136 malades.

Ce qu'il faut d'abord retenir au moment de poser le diagnostic, c'est qu'il s'agit de garçons ou de jeunes gens, mais du reste c'est l'hémorragie et son caractère qui sont décisifs. C'est le saignement rectal profus, survenant par crises avec évacuation de sang pur contenant des caillots, et moins fréquemment l'accès violent de melaena, qui éveille les soupçons. Par contre la douleur a moins de poids, elle peut pourtant avoir de l'importance si l'y a corrélation avec les repas. On peut, dans d'assez nombreux cas prévoir qu'il s'agit vraiment d'un diverticule de Meckel en examinant l'aspect de l'ombilic. Une forte rétraction ou un creusement particulier de l'ombilic, de même que sa proéminence spéciale, peuvent quelquefois indiquer une oblitération défectueuse du canal omphalo-mésentérique. Les fistules ombilicales survenant après la naissance (comp. la présente observation I, où la chute du cordon ombilical ne se produisit que quinze jours après l'accouchement) aboutissent à une constatation du même ordre. Je dois faire observer que, parmi les journaux de 22 malades atteints d'affections différentes dans le diverticule de Meckel, DRUMMOND trouva cinq cas d'altérations ombilicales de la forme décrite ici, sans qu'il y ait eu d'examen spéciaux à ce sujet.

Cependant, dans le cas où l'on a constaté un saignement rectal d'un caractère plus ou moins typique, le diagnostic n'est pas établi de ce fait avant que l'hypothèse d'une série d'autres affections accompagnées de saignement rectal soit écartée. Le plus souvent c'est le diagnostic d'invagination intestinale qu'il faut éliminer. En général on évite la confusion, si l'on se rend compte des différences suivantes. Dans l'invagination on n'observe ordinairement que des hémorragies peu abondantes, mélangées de mucus d'une odeur caractéristique. Le mucus n'apparaît jamais dans l'ulcère meckélien, où la tumeur d'invagination est en outre

absente A la différence de l'affection diverticulaire, l'invagination est caractérisée par l'état d'iléus précoce, enfin l'examen radiologique sera décisif

Quelquefois on est à même de constater au toucher rectal des polypes saignants dans le rectum, dans d'autres cas, c'est la proctoscopie ou l'examen radiologique qui révèlent leur présence éventuelle

Les ulcères gastro-duodénaux accompagnés d'hémorragies et de perforation éventuelle sont extrêmement rares chez les enfants, et par conséquent on pourrait les laisser hors de considération Des affections semblables chez les malades plus âgés ne causeraient guère de difficultés au point de vue du diagnostic différentiel

Les côlites et les proctites ulcéreuses, chez les malades plus âgés, et, chez les enfants, les entérites très aiguës accompagnées d'un peu de sang dans les selles, offrent en général un tableau clinique tout autre

Dans quelques cas l'hypothèse d'un purpura abdominal n'a pas pu être écartée (THOMSON, FARR & PENKE, JACKSON) De cette forme de purpura ont été rapportés une série de cas dont il ressort que les symptômes abdominaux peuvent évoluer quelques jours avant l'exanthème et les symptômes articulaires Le tableau abdominal avec rigidité et sensibilité éventuelles donne l'impression d'une péritonite, et une hémorragie rectale synchronique présente un tableau impossible à distinguer de celui mentionné ici

Donc, d'une façon générale, il est évident qu'il faut poser le diagnostic per exclusionem, comme résultat d'un examen qui, pour être *lege artis*, doit comprendre la proctoscopie et l'examen radiologique du tube digestif

Les cas perforés sans hémorragies ressemblent beaucoup, dans les stades initiaux, à l'appendicite perforée Souvent sensibilité et rigidité ont leur point maximum dans la ligne médiane ou dans la fosse iliaque gauche, sans que ce phénomène constitue aucun signe distinctif sûr MONDOR souligne à juste titre que la température initiale est moins élevée dans l'ulcère meckélien perforé que dans la péritonite appendiculaire initiale La mise en évidence, par examen radiologique, de gaz épanché dans le péritoine n'a que de faibles chances de réussir, mais il a pourtant été observé dans un seul cas (GREENWALD & STEINER)

*Pronostic* A titre d'éclaircissement sont présentés les chiffres suivants comprenant tous les cas publiés

Ulcères perforés, opérés 75, dont 18 décès (c'est-à-d  $1/4$ )

Ulcères non peifores, opérés 52, aucun décès

Parmi les malades opérés ou non opérés, sans que le diverticule ait été enlevé, se trouvaient 5 cas avec perforation et 4 cas sans perforation, tous ces malades moururent

Cela veut donc dire que le pronostic est absolument bénin, aussi longtemps que l'ulcère n'est pas perforé et qu'on intervient chirurgicalement par extirpation du diverticule. Dès que la perforation se présente, les perspectives de guérison sont considérablement diminuées. Ici, comme dans d'autres perforations en péritome libre, plus l'intervention se produit rapidement plus bénin sera le pronostic, la mortalité relativement élevée de 25 %, pour les cas peiforés opérés, est due à ce que dans un nombre de cas l'opération n'a eu lieu que 12 heures ou plus après le début de la perforation. D'un autre côté, il ne faut pas oublier que les pourcentages de mortalité constituent un minimum, étant donné qu'on est toujours moins enclin à rapporter les cas léthifères.

Sans opération, le pronostic, comme on le voit, est toujours grave.

*Le traitement* est exclusivement opératoire. Les essais de traitement médical (régime anti-ulcéreux) comme proposés par C. W. MAYO et d'autres, doivent, si l'on retient les chiffres sus-mentionnés, être considérés comme absolument inadmissibles.

L'opération, souvent précédée d'un traitement adéquat de transfusion de sang, consiste généralement en l'extirpation simple du diverticule. Pour des raisons techniques (diverticules géants, diverticules à base large, etc.) une résection intestinale s'impose quelquefois. Dans les cas accompagnés de péritonite et d'iléus paralytique débutant ou manifeste, la méthode adoptée par AALKJÆR, décrite et appliquée dans la présente observation III, est la méthode la plus modérée, et ainsi une entérostomie est établie d'une manière simple. Mais la méthode principale doit être l'extirpation simple.

### Résumé.

25—50 % des diverticules de Meckel examinés contiennent de la muqueuse gastrique. De ce fait il peut se produire des ulcères

de la même manière que dans l'estomac et dans le duodenum L'affection ainsi survenue — ulcère peptique du diverticule de Meckel — fait, sur la base de 4 nouveaux cas et de la littérature, l'objet d'un examen quant à l'anatomie pathologique, à la clinique, au diagnostic, et à la thérapeutique L'affection est caractérisée par les accès d'hémorragies profuses par le rectum et la perforation fréquente de l'ulcère Des cas connus, environ 60 % étaient compliqués de perforation, et il est remarquable que la perforation arrive fréquemment au decours d'une hémorragie

Le diagnostic est posé per exclusionem et doit être précédé d'un examen rectoscopique et radiologique du malade

Tous les cas non traités ont entraîné la mort, il faut donc recourir à un traitement adéquat et pratiqué à temps, c'est-à-dire l'extirpation immédiate du diverticule, dès la position du diagnostic

### Summary.

From 25—50 % of examined Meckel's diverticula contain ventricular mucous membrane and therefore ulcerations can arise in a similar manner as in the ventricle and duodenum The disease which has thus arisen — *ulcus pepticum diverticuli Meckeli* — is made the subject of investigation, with regard to clinic, diagnosis and therapeutics, based on 4 new cases and literature The outstanding features about this disease are the profuse, periodic rectal hemorrhages coupled with the strong tendency to perforation which the sore has About 60 % of the known cases are perforated, much importance is attached to the circumstance that perforation often arises in direct connection with the attacks of hemorrhage

All known fatal cases were untreated, early, adequate treatment, that is to say, immediate extirpation of the diverticulum, should be resorted to as soon as the diagnosis is made

### Zusammenfassung.

25—50 % der untersuchten Meckel'schen Divertikel enthalten Magenschleimhaut, und hier können in ähnlicher Weise wie im Magen und Duodenum Ulzerationen auftreten Die hierbei entstehende Krankheit — *Ulcus pepticum diverticuli Meckeli* — wird an Hand von 4 neuen Fällen sowie des Schrifttums zum

Gegenstand einer Untersuchung gemacht inbezug auf ihre Klinik, Diagnose und Therapie. Das Charakteristische dieses Leidens sind die profusen, anfallsweise auftretenden Rektalblutungen sowie die starke Neigung des Geschwulsts zur Perforation. Von den bekannten Fällen waren etwa 60 % perforiert, und zwar wird als sehr wichtig hervorgehoben, dass die Perforation oft im direkten Anschluss an einen Blutungsanfall auftritt.

Ohne Behandlung starben alle bekannten Fälle. Sachgemasse Behandlung, d. h. sofortige Exstirpation des Divertikulum, ist deshalb anzustreben, sobald die Diagnose gestellt ist.

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# On Cancer Ventriculi.

A Clinical Study

By

ÅKE GREVILLIUS, M D

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It may, perhaps, seem unnecessary to publish the following reflections on cancer of the stomach since much has been written about it and it may seem that there is little to add. Its pathological anatomy, diagnostics, therapy, prognosis etc. have been dealt with from various viewpoints by a number of different authors. In the majority of the works dealing with the clinics of the disease, a more or less pronounced pessimism prevails. And, indeed, this would seem to be quite justified, as the outcome of our endeavours to get the better of this dreaded ailment cannot be said to be encouraging. About 40 % of all cancer mortality is caused by ventricle cancer (GULEKE), this type of tumor craving more human lives than malignant tumors in the face, oral cavity, throat, expectoration glands, larynx, thyroids, breast, and uterine ovaries together. But exactly because so many suffer from cancer ventriculi, very slight progress in diagnostics and therapy may, at any rate in a good number of cases, bring about an obvious improvement, while in others it may indeed have a life-saving effect.

Ever since a visit in 1934 to the well-known stomach surgeon Professor FINSTERER in Vienna, the author has taken a great interest in ventricle surgery and as regards cancer has constantly endeavoured to operate as radically as possible, though conscious that the risk element in the operation was on several occasions considerably increased. After the lapse of a decennium I have endeavoured to collect the cases of ventricle cancer on which I

have operated during that time Their number is not imposing, hardly more than a hundred About half of the operations were performed in the surgical department of the Central Hospital at Linköping (chief Dr N V ÅKERBLÖM) and at the Academic Hospital, Uppsala (chief Professor G NYSTRÖM) The other half at the Central Hospital at Jönköping (chief Dr L BERGSTRÖM) After-investigation has only occurred in cases where resection or gastrectomy was performed Altogether I have managed to trace about fifty cases To apply statistical methods to such a small material is obviously out of the question Moreover, medical literature contains a great amount of statistical information from various quarters Thus the following only claims to present a few reflections which have arisen out of the study of the cases, which may be of interest to some

First, as regards the symptomatology, there is little to say Severe pain is unfortunately, as we know, a symptom of late appearance Lack of appetite, sometimes to the point of disgust at food, vomiting, a feeling of depression and other diffuse trouble not much spoken of, too often send the patient to a doctor only when the disease has reached an irreparable stage

Examination of the gastric juice generally discloses achylia but the existence of fully normal acid values by no means excludes cancer in the ventricle any more than negative outfall of Weber's test in series investigations of faeces The blood sedimentation reaction is of small diagnostic significance, as is well known In the present material in a large number of cases the S R value lay between 5 and 8 millimetres

In view of the above-mentioned often very slight initial symptoms we see that the public needs more enlightenment, for, notwithstanding all that has been done of late years, patients seek medical advice much too late The doctor who has a middle-aged or elderly patient suffering from stomach trouble must be constantly on the watch against cancer "Magensbeschwerden irgendwelcher Art sind besonders bei älteren Personen so lange für krebserdächtig zu halten, wie sie nicht sicher harmlos erkannt worden sind!" (KONJETZNY)

An example of the danger of taking a patient's stomach trouble too lightly is afforded by the following case

Man, 36 years old Father died of cancer ventriculi For 5 months lack of appetite, suction feelings in the epigastrium and pain immediately after food Patient described the pain as going in waves from left

to right He visited a doctor who prescribed stomach powder without examining the gastric juice or excrement and had no X-ray investigation After X-raying a large tumour infiltration was discovered in the canalis and sinus region with considerable retention *Op Resectio ventriculi + G E terminolat 1 c* Large tumour firmly attached to mesocolon transversum which, however, could be detached Abundance of glands in omentum min The ventricle was parted immediately below the cardia Subsequent course uneventful Home, healed and free from symptoms Half a year later the patient returned with extensive return of glands In this case the doctor, first consulted, was probably induced by the patient's youth to fall into the dangerous error that it was merely a case of catarrh of the stomach But even the kind of pain suffered ought to have aroused a suspicion of stenosis

*Ulcus ventriculi and Cancer* HAUSSER's assertion (1883) that cancer may be developed in gastric ulcers has been confirmed again although opinions as to its frequency have varied very much While some writers (R SCHMIDT, SILVA, MELLO) consider that ulcer and cancer practically exclude one another, and others (DITTRICH, FABER, EWING NIELSEN) deem the possibility of a cancer degeneration very small, cancer can, according to PAYER, be suspected in every callous wound At a Congress of Surgeons in 1910 KUTTNER and PAYER, as a result of the investigations of their resection material, gave the high figures of 43 % and 25 % respectively cancer degeneration The results of ANSCHUTZ and KONJETZNY, based on thorough investigations and showing from 3 to 5 % cancer degeneration in all gastric ulcers probably come near the truth

In callous ulcers cancer formation is more common than is generally believed The surgeon would be wise to pay great attention to the opinion of PAYER quoted above Besides, in concrete cases, what does percentage matter The practically important thing is the fact that cancer degeneration of callous ulcers is relatively common, that it is often impossible to detect it in an X-ray photograph and that even at an operation it may be absolutely impossible to decide whether cancer is present or not Indeed even in a histological investigation it may be difficult to diagnose

From the foregoing it follows that callous ulcers should receive the greatest possible attention and unless they heal within a short period, they should be the object of radical resection The patient's age does not matter, cancer change is common even in relatively young individuals

The following is an example of the danger of treating an *ulcus callosum* internally for too long a time

Man of 48 Previously healthy *stomach* Two years ago sudden great vomiting of blood Received at medical department X-raying showed immediately below *cardia* a large flat niche the size of a thumbtip A month later it was evidently less but the wall of the ventricle seemed somewhat rigid below the niche After another month's cure the niche was gone and the rigidity of the wall seemed less, but was not gone altogether The patient was sent home with a dietary Nine months later he was re-examined, all the time having been free from pain X-ray investigation revealed the following "No niche discoverable *Curvatura minor* somewhat rigid but ventricle has otherwise gentle and even contours" After yet another half year, the patient being still quite healthy, the X-ray picture had altered so that a tumour was indicated Laparotomy was performed and a large immobile tumour was discovered in the upper part of the ventricle with abundant glands around the aorta The abdomen was closed and no steps were taken The man did not die, however, until after more than nine months The rigidity demonstrated in the *curvatura minor* at the X-ray investigation and which remained at the third investigation ought even then to have led to the patient's being handed over for surgical treatment Had that been done, his life might possibly have been saved

Equally tragic is the following case, recently operated on by the author

Man, 37 years old Periodical *stomach* trouble since the winter of 1939—40 when he sought medical advice for the first time He was given medicine and felt better for a time but the trouble returned at intervals of about half a year In 1941 he was X-rayed for the first time "Ventricle ulcer on *curvatura minor*, near *pylorus*" Was at another hospital for ulcer cure in Jan and Feb 1942 Discharged on improvement The following summer another period of trouble In November of the same year again admitted to hospital when an ulcer was discovered on *curvatura minor* very near *pylorus* Unfortunately resection was not performed, only a G E was applied Half a year after the operation the old trouble returned pains in the epigastrium, sour vomiting etc In Feb 1944 he was admitted to the medical department of the Central Hospital at Jonköping X-ray investigation yielded "Mucous membrane of ventricle swollen, particularly in the sinus region where there is an ulcer crater, somewhat irregular, the size of a coffee bean" As he got no better after the cure and the niche appeared plainer and larger on the X-ray picture, he was sent to the surgical department for operation It had to be postponed about a month on account of an *angina tonsillaris* X-raying in May displayed an obvious change On operation an ulcer crater, the size of a finger-tip, was discovered at the *angulus* surrounded by considerable induration Several glands, almost the size of a hazel-nut, were visible on the major side close to the pancreas *Omentum majus* was removed and a resection of the ventricle was performed All the palpable glands could be removed

G E was applied so high on *curvatura major* that it could be retained. The resected part of the stomach was sent away for histological investigation of which the result was "About the middle of the resection an ulcer the size of a farthing with already macroscopically suspicious surrounding. The microscopical sections showed that one had to do with an old callous ulcer. The mucous membrane edge of the ulcer had undergone cancer alteration and deep down in the scarred connective tissue one could see fine bulbs of atypical epithelium cells. A few of the accompanying glands proved to contain cancer" (FÄHRÆUS). Recovery was free from complications and the patient went home ten days after operation glad to be rid of his old trouble. Unfortunately his prospects of permanent health must be deemed rather small, even if he may hope for a longer time free from trouble than he would have had in the absence of an operation.

The application of an anastomosis to an old callous ventricular ulcer, as occurred in the latter case, must obviously be regarded as a technical error. Apart from pylorus stenoses it is surely extremely seldom that there is any reason to apply a G E. To apply one and then leave a callous ventricular ulcer when there is no absolute contraindication against resection must be deemed unpardonable. The mortality after resection for callous ventricular ulcer can be reduced to an insignificant percentage. FINSTERER has 90 % freedom from trouble after five years for all resected callous ulcers, 50 % with no trouble in the cancer-degenerated ones. Considering that some patients, though maybe not many, with callous gastric ulcer die under internal treatment, the foregoing figures showing 90 % healthy after five years constitute a strong argument for surgical therapy. Moreover, considering the great risk of malignant degeneration and also the fact that neither clinically nor by X-raying can it be discovered whether and when any such fatal change in the nature of the ulcer has occurred, there would seem to be every reason for advising an operation when an ulcer niche established by X-raying does not disappear within six months or thereabouts.

In all probability cancer can be developed from other pathological changes in the stomach as well, e g polyps and certain forms of gastritis.

Concerning the former LUBLIN has recently related a case where a polyp was established by gastroscopy. The patient was earnestly advised to put himself under continuous observation. He did not, however, return until after a couple of years and was then found to have a cancer which could not possibly be operated on. Among the writer's cases there is a similar one of which an account is given below.

It is KONJETZNY's opinion that cancer may arise on the basis of both a hyperplastic and an atrophic gastritis and that, at any rate, the former should be regarded as precancerous state. Obviously every case of hypertrophic gastritis should in all circumstances be carefully followed, as also cases where one or more polyps have been discovered. In cases of this kind gastroscopy may surely be of great importance. It is really safest to recommend operation for all polypous changes. Nor should we be too loath to operate for hyperplastic gastritis. As regards atrophic gastritis, however, it seems to me more difficult to decide on resection.

In all these cases intimate co-operation between physician and surgeon is of the greatest value.

*X-ray findings* X-ray investigation is undoubtedly of the highest importance for making an early diagnosis although, owing to the nature of the disease it occurs far too seldom. It must be remembered that an expert X-ray investigation is usually able to throw light on the majority of cases even at an early stage. It is, of course, still possible for a ventricular cancer to be overlooked in spite of highly developed technique and great personal experience on the part of the X-ray specialist. Consequently there are cases where, notwithstanding a negative X-ray result, one may be justified in performing a trial laparotomy grounded on the clinical symptoms. When the result of repeated X-ray investigations is uncertain — obviously there should be control investigation at short intervals — the indication to an exploratory operation exists.

Such cases will probably be more and more rare. "Die Verfeinerung der Untersuchungsmethoden gibt uns Mittel in die Hand Geschwulstbildungen von Mandel- bis Hasselnussgrosse rontgenologisch zu erfassen" (SCHINZ). The surgeon at a hospital where there is no expert X-ray operator should therefore send all suspected cases to such a one. When early cancer is suspected, the first thing is to observe changes in the mucous membrane. The interpretation of these requires a specialist. It is not difficult to detect filling defects in a contrast mass but how many small mucous membrane changes may get lost in the massive shadow of a filled ventricle.

Occasionally X-raying can detect tumours so small that in an operation they may be well-nigh impossible to touch and find. The following cases are extremely fine examples of this.



Fig 1



Fig 2

GREVILLIUS On Cancer Ventriculi



Fig 3



Fig 4

Man, 58 years old Since Xmas 1936 pain and aching in epigastrium some hours after food, spreading out into the back Frequent vomiting Saw a doctor in Jan 1937 Diet prescribed but got no better In summer of 1937 dark excrement Admitted to the Academic Hospital, Uppsala X-ray examination yielded "Filling defect in canalis near curvatura major fully as big as a pea, probably a polyp No other sure changes Near pylorus a starshaped fold which can be compressed so that probably there is no question of ulceration Bulbus duodeni u a After 3 hours no retention Gastric juice, when examined, showed achylia <sup>14</sup>/<sub>7</sub> *Op Laparotomia explorativa* Middle line incision Ventricle found to be completely normal No polyp perceptible Liver, gall bladder, pancreas, colon quite fit Abdomen closed without further steps Patient discharged with dietary prescription and HCl On <sup>8</sup>/<sub>2</sub> he was again admitted Ever since his discharge he had almost daily had a grinding, smarting pain in the pit of stomach Since the fall of 1938 the trouble had increased with heartburn, acid vomiting nausea and coffee-dregshlike vomit Had visited a doctor and received a powder which had relieved the pain The last few months his appetite had successively decreased, and he had had typical retention vomit The patient seemed cachectic X-ray examination "Cascade stomach of rather unusual shape, partly due to a tumour infiltration along the curvatura minor In the distal part of the canal a polyp of full pea-size is visible Bulbus duodeni deformed and displaying a mucous membrane with ray-like marking and a big lateral recess No niche visible Remains in ventricle twice the size of a tablespoon" <sup>13</sup>/<sub>2</sub> *Op Subtotal gastrectomy* Along curvatura minor a considerable tumour infiltration was discovered which reached approximately up to the cardia and down to a few centimetres from pylorus Ventricle firmly adherent to pancreas and mesocolon A few glands in omentum minus Duodenum, divided immediately below pylorus, was closed and invaginated with catgut and silk sutures and covered with oment The ventricle could be loosened from mesocolon without injury to the colon vessels From pancreas it had in part to be loosened with knife Omentum minus was divided as high up as possible Of the remaining part of the ventricle a tube was formed which was connected with the jejunum terminolaterally A small enteroanastomosis was applied The slit in mesocolon was sewn to the front and back sides of the remainder of the ventricle Prep Large ulcerating cancer Pathological examination Ulcerating cancer of simplex-scurrhous type broadly infiltrating the ventricle wall out to the omentum, where a few large lymph-glandmetastases are situated Within cancer area a simple mucous membrane polyp whose lateral parts are drawn into the cancer-changed area The investigated parts of resection edges were free (GELLERSTEDT) The patient was discharged free from symptoms on <sup>6</sup>/<sub>3</sub>

At the first operation when no changes could be felt, an exploratory gastrotomy should undoubtedly have been performed Possibly there were then no mucous membrane changes, but

they cannot be excluded, and a resection undertaken at that point might conceivably have saved the patient's life

The following case, a recent operation by the author, is instructive from this point of view

Man, 60 years old 1937 admitted to nonsurgical department for pernicious anaemia Ventricle X-ray negative Achylia From beginning of March 1944 tired and languid, troubled by indefinite stomach pain and now and then by diarrhoea Admitted on  $15/5$  to nonsurgical department of the Jonköping hospital Colon X-ray negative X-ray examination of ventricle on  $22/5$  "Since former examination a pathological process has appeared in the canalis region Here there is a constant circular retraction about 2 cm from the pylorus and one can feel a small shiftable resistance When this region is compressed, the normal longitudinal mucous membrane folds do not appear Instead there is an irregular structure indicating wall infiltration In all likelihood a small cancer infiltration" (ENGBERG) On  $24/5$  Op *Resection ventriculi ad modum Billroth I* Middle line incision Ventricle apparently normal At curvatura minor, however, after accurate palpation one seemed to feel a slight thickening in the wall Gastrotomy was consequently performed and a slight induration rather larger than a sixpence was found In ligamentum gastrocolicum some hard glands Resection was decided on Omentum majus removed Duodenum was divided immediately below pylorus Fully  $2/3$  of ventricle was resected Ventricle cross section was somewhat diminished, whereupon gastro-duodenostomy was performed without any tightening with silk and catgut sutures in two rows Histological examination of the preparation showed "In the piece of ventricle sent in there was found a small low-differentiated adenocarcinoma which in the incisions only infiltrates into the sub-mucous and the innermost layers of muscularis Just under the cancer a small lymph gland was discovered in the wall, containing metastatic cancer vegetations" (REUTERWALL) In this case X-ray examination was evidently of greater value for the diagnosis than even laparotomy

Finally a third case of possibly greater interest than the foregoing

Woman, 52 years old Since Sept 1940 periodically X-rayed for t b c lymphome and t b c of the skin In 1941 admitted to non-surgical department for indefinite abdominal trouble X-ray ventricle negative Achylia established Sent home free from symptoms with HCl

In April 1942 stomach trouble again, pain in pit of stomach, vomiting, heartburn etc Lost 12 kilograms of weight in four months Very poor appetite Admitted to surgical department of the Jonköping Hospital on  $8/8$  1942 X-ray examination "With exception of fornix bladder, ventricle transformed into a rigid pipe hardly as wide as two fingers Scirrhus cancer ventricule (OLSSON) (Fig 1) On  $12/8$  Op *Laparotomia explorativa + Cholecystectomy* Middle line incision Wall of ventricle

seems thickened up to the fundus where it is of usual appearance. It was not possible, however, to perceive any infiltration that roused such suspicion of tumour as to motivate a gastrectomy which would be the only conceivable operation. A piece of all the layers of the thickened ventricle wall was cut out for histological examination. A finger was passed through the hole for palpation of the mucous membrane which was everywhere smooth and even. Gall bladder large and extended. In it a large concrement was perceptible. Cholecystectomy in usual manner. Primary suture.

Microscopic examination of the piece of ventricle cut out displayed the following: "Mucous membrane of ventricle displays rather pronounced inflammatory changes with oedema, increase of plasma cells, rather numerous RUSSELL bodies and in places small assemblages of leucocytes with polymorphous nuclei and one or two eosinophile cells. Sub-mucous thick, connective tissue sclerotic with scattered plasmolymphocyte infiltration. Muscularis appeared hypertrophic. Subserosa and serosa displayed no particular features. No sign of cancer or any other malignant process" (H. HANSSON).

It goes without saying that the reception of this answer made me very glad of not having performed a bigger operation. However, the patient returned about a year later. During the last half year she had not been able to take any solid food without vomiting. Her weight had gone down from 85 to 47 kilograms. Admitted 10/7, 1943. X-ray examination: "Ventricle lumen in region of infiltration had shrunk further to scarcely the width of a pencil. Moreover, a considerable shortening of the infiltrated area had taken place" (BRÖDÉN) (Fig 2). On feeling of abdomen a rather large mobile resistance could be felt. On 20/7, Op. *Gastrectomia totalis + Oesophago-duodenostomia*. Ventricle transformed into a firm, thick pipe, freely mobile. No glands could be seen or felt. Duodenum was divided near pylorus in apparently perfectly normal tissue. Curvatura major and minor underwent free preparation with removal of the omentum majus. The interabdominal part of the oesophagus was rather long. A soft compressor having been applied it was burnt through with diathermy near the cardia. Duodenum having then been mobilized, could be drawn up towards oesophagus with which it was united by two rows of sutures which were so applied that the oesophagus stump was overturned into the duodenum. A couple of supporting sutures were fixed between duodenum and diaphragma and the border of the sutures was covered with omentum. A duodenal catheter was passed through the throat and down to the uppermost part of the jejunum. Primary suture. Pathological-histological examination: "The whole ventricle wall transformed into a small-cell cancer of scirrhus type" (KLING). After-course completely free from complications. X-ray examination two weeks after operation showed following: "At the transition between oesophagus and the raised duodenum there is a slight extension of lumen. For a length of one decimetre next to the oesophagus the lumen is of the width of a finger, below it the greatly widened pars horizontalis inferior commences. Just in front of the transition to the jejunum the duodenum displays a slight con-

stant narrowing The duodenum, as a whole, somewhat resembles a ventricle" (BRONÉN) (Figs 3 and 4) An alteration of shape of this kind after gastrectomy has been mentioned from other quarters The patient is now a year after operation, still free from symptoms

In this latter case there may possibly be a misinterpretation of the microscopical pictures at the first pathological-anatomical examination The changes in the wall of ventricle must, at any rate, have represented a precancerous stage This, however, like the first two cases, shows the great value of X-ray investigation and the duty of attaching the greatest importance to the same It is quite obvious that when there is the least doubt one ought to perform gastrotomy and be willing to take the risk

*Methods of operation* As radiological treatment is quite ineffective in cancer ventriculi, an operation is the only way to save the patient's life Consequently it is urgently necessary to make use of the best methods for the operation The so called "radical operation" which can be performed in certain other forms of cancer, i. e. the removal of the organ affected and evacuation of regional lymph glands is extremely difficult and, in the majority of cases, impossible to perform in cancer ventriculi The "radical operation" would imply removal of the whole ventricle of omentum majus, ligamentum gastro-colicum, ligamentum hepato-gastricum and the anterior peritoneal covering of the colon transversum However highly developed one's technique may be, this extensive operation involves a distressingly high mortality and must therefore be reserved for a few cases particularly suitable for it HÖRST performed 12 such operations with 33 % immediate mortality, but all of the surviving patients died within 4 months to one and a half years He considers that total gastrectomy should be undertaken in corpus and fundus cancers which have not yet spread to the immediate neighbourhood of the cardia while cases where the whole ventricle is in the grip of a tumour must be regarded as so bad from the prognostic viewpoint that it is not worth while to operate For my part I hold that in addition to tumours with above-mentioned localization to corpus and fundus, a diffuse scirrhus cancer which infiltrates the whole stomach should be the object of total gastrectomy unless widespread gland metastases occur Very often, however, a scirrhus engages the gland system rather late Three of my own cases seem to support this view

Careful histological investigations (EKER) have shown that

cancer cells can be found at least 5 cm from the macroscopically visible or palpable tumour infiltration. Resection must consequently be performed at this distance from the tumour. This implies in practice that most operations for abdominal cancer must take the form of a so-called sub-total gastrectomy. In connection with the removal of the omentum majus and ligamentum gastro-colicum together with the division of the omentum minus as high up as possible this will probably not increase mortality perceptibly and may improve the final results. In this subtotal gastrectomy, as indeed in all resections for cancer ventriculi, most authors hold that anastomosis should be performed in accordance with Billroth II. The main reason for this is that if a relapse should occur in the ventricle itself, a stenosis would more likely be the consequence in a gastroduodenostomy. Moreover, the healing tendency is poorer than in ulcer and even a slight tightening of the suture line may more easily provoke a suture insufficiency. In very high resections where the incision on the minor side begins just below the cardia, I have in several cases allowed the ventricle cross section to be diminished by continuous sutures in two rows with catgut and silk from the minor side, whereby the ventricle remainder has been re-formed into a pipe-like figure which was directly joined to the duodenum. In no case has any tightening been observed. Remembering that after these big resections the duodenum is often so extended as to imitate a small ventricle, this procedure seems to me to be quite as reasonable as to sew the upper part of the jejunum to the ventricle which, in these cases, may actually cause more trouble. If a relapse should occur, the patient's fate is sealed anyhow.

As was said above, one should in cancer ventriculi seldom be satisfied with a less thorough operation than *subtotal resection*.

As a middle stage between this and total gastrectomy there is the operation where, to be sure, the whole stomach is removed but the cardia ring is preserved. HOLST calls this *total gastrectomy with preservation of the cardia-ring*. He employs it with corpus and fundus tumours where there is a ventricle wall of five centimetres free between the tumour and the cardia. The operation causes far less mortality than total gastrectomy because the sutures can grip the cardia musculature. On the other hand, it is more radical than sub-total gastrectomy, since no ventricle remainder is left.

Thus the three operations that are employable when it is in-

tended to perform a radical operation are sub-total gastrectomy, gastrectomy with preservation of the cardia ring and total gastrectomy

Concerning the last it is still so seldom performed that it is deemed appropriate to give an account of odd cases which were successful. The writer has performed the operation in nine cases, five of which survived the operation well, while four succumbed. Of the cases which ended fatally, two should not have been the object of operation. One of them was a man of 74. The writer had not at the beginning of the resection ascertained how far up on the ventricle the tumour stretched. To avoid resection of the tumour tissue a total gastrectomy had to be undertaken which a priori was too big an intrusion with respect to the patient's lowered vitality. The carrying-out of an operation under these circumstances is, to say the least, uncomfortable. The case was a serious reminder always to establish the operability of a ventricle tumour before undertaking a resection. In the second case the cancer at a place directly infested the liver in which, however, no metastases could be proved, and a minor resection of the liver tissue had to be made, which surely is a measure one would rather not undertake.

In the two other cases there were clear indications fundus tumours without any surely palpable gland metastases and a good general condition. The cause of death in one was acute insufficiency of the heart, in the other a purulent pyelitis. The section displayed in both cases a normal field of operation. Four of the five survivors underwent an oesophago-duodenostomy, one an oesophago-jejunostomy. The latter died from pulmonary tuberculosis after 2 months. Three of the former are still alive and healthy after one year, 7 and 6 months respectively. The third died at home after 1½ year, having then considerable ascites.

All these three had a widespread scirrhus cancer, a tumoral form which, as I have said in the foregoing, in my opinion ought in suitable cases to be the object of a total extirpation of the stomach.

In order to prevent as far as possible the strongly infectious contents of the throat from descending into the abdominal cavity, the writer during the operation leads down a duodenal catheter which is connected with water suction. Before the anterior suture rows are applied, the catheter is brought down through duodenum into the uppermost part of the jejunum and

during the first week the patient receives nourishment through the same

It is of great importance that a patient for whom a total gastrectomy is planned should be prepared by thorough oral hygiene and is put on a proper water balance which latter should be the object of daily control after the operation, dehydration and low serum protein being present in almost all cases

As already mentioned, I consider it an advantage to be able to attain a direct anastomosis between the throat and duodenum. The following X-ray photographs are derived from the above-mentioned patient where neither the finding at the trial laparotomy nor the histological investigation revealed the true nature of the disease. Figs 3 and 4 show the peculiar, stomach-like widening of duodenum which was developed only a few weeks after the gastrectomy

In 47 cases I performed sub-total gastrectomy or, if the cancer was located near pylorus, high resection. The omentum majus and ligamentum gastrocolicum were always removed and omentum minus was divided as high up as possible. The primary mortality amounts to 90 %. As was said above, the figures are all too small to allow any statistical calculation. I venture, however, to say, that this operation which is more extensive than the resection usually practised, where the stomach is divided perhaps only one or two centimetres from a palpable tumour does not imply greater risk than the latter. In one case a gland the size of a goose egg was removed from the monetum minus, in another a packet of glands around the coeliac artery. Both well one and a half year after operation.

One ought not to relinquish even a far-reaching operation although it may not be possible to remove all the glands met with. One cannot macroscopically tell whether they are cancer-infiltrated glands or adenites. After the removal of the primary tumour the metastases can, in all likelihood, be annihilated by the organism. M. B. SCHMIDT has shown that cancer cells in large numbers enter the lungs in cancer of the digestive organs and perish there. Cancer glands left behind are therefore *not bound* to be further developed. Many times, of course, they do so and with amazing speed. The following example may be adduced.

Woman, 55 years old. Op 7/7, 1943. Canalis region occupied by a large tumour firmly grown into mesocolon transversum but otherwise free. It could be loosened without injuring the colon vessels. No glands

at all were discovered Omentum majus was removed, omentum minus was divided high up Termino-lateral gastro-jejunosomy Sent home free from symptoms Only two months later she came back with a big mass in the scar Laparotomy was performed The anastomosis was surrounded by cancer masses which had infiltrated the abdominal wall Another woman was in an approximately similar state when operated on She got a major relapse in the abdominal wall after five months But such disheartening experiences must not keep the operator from operating as radically as possible

To be sure, one meets with a great number of cases where one realizes at once that radical aid cannot be rendered, even when resection of the tumour is possible In my opinion, one should not in such circumstances neglect to remove the primary tumour If the patient survives the operation, his life is almost without exception prolonged and, above all, he escapes the dreadful suffering which precedes death from a stenosing cancer

Nor should any cancrescence with mesocolon, pancreas or other organs deter the operator from an attempt to remove the tumour One of the writer's cases is alive and healthy four years after operation Here the tumour was intimately bound up with both mesocolon and pancreas, being freed by diathermy

*Anaesthesia* In the great inroad which a resection operation on a cancer patient who is often extremely run down implies, the choice of anaesthetic is naturally of very great importance

Spinal anaesthesia, as also a general narcosis with ether, must be considered as unsuitable

According to BRAUN, splanchnicus anaesthesia, properly employed, is a good narcotic although one sometimes sees "Versager" which cannot be referred to defective application of the infection fluid In this connection it may be pointed out how widely the sensibility in the splanchnicus region seems to vary In three cases I have performed resection according to Billroth I with no other narcotic than local anaesthesia in the abdominal wall and with not the least reaction on the part of the patient

Of late years I have usually employed local anaesthesia of the abdominal wall together with evipan or narcotal Aged patients, as a rule, only need small doses, especially if, as a preparatory narcotic, tetrapon-scopolamin is given one to one and a half hour before the operation At the examination for an estimation of the operability of the cancer, it is well for both the patient and the operator if the former is unconscious, especially when the case is a hopeless one

*Operation results* Primary operation mortality is very variably indicated in different statistics. Some figures may be adduced. Out of 157 resections VON EISELBERG's clinic had 20 %, MAYO (736 resections) 13,7 %. The mortality is naturally in a very high degree dependent on the indication position. FINSTERER divided his cases into three groups, yielding the following results

1. Easily operable, free tumours without concrescences with the surrounding parts. No or few lymph glands. 129 cases. 6,9 % fatal.

2. Tumours firmly grown on to mesocolon, colon transversum, pancreas, liver or milt. 61 cases with 37 % mortality.

3. Palliative resections. 15 cases with 33 % fatal.

As was mentioned above the mortality in my own material, light and severe cases together, total gastrectomies not included, however, amounts to about 9 %, which is a relatively low figure.

Anyhow, the permanent results of operations for cancer of the stomach are still sadly discouraging. In this respect too, the figures of different surgeons vary a good deal. FINSTERER has 21 % living after five years or longer and 26,6 % after three years. HOLST gives the numbers 10 and 21 % respectively after 129 resections. OGILVIE 29 % alive after five years. This latter figure seems rather high.

An after-investigation of the writer's material yielded far poorer results.

Alive after 5 years	— 1 = 2 %
» » 4 »	— 5 = 10 %
» » 3 »	— 6 = 12 %
» » 2 »	— 12 = 24 %
» » 1 »	— 27 = 54 %

Within a year after the operation twelve had died. In four of these cases a palliative resection had been performed.

Thus, only a very small proportion of those operated on had been restored to permanent health. Yet I believe that it can be asserted that most of those who survived the operation had had positive benefit of the same although, sad to say, it was of brief duration.

Although the results hitherto obtained are far from satisfactory, we should not allow ourselves to be disheartened when we are concerned with attempts to bring not only relief but

definite healing to the greatest possible extent to those suffering from cancer of the stomach

At the risk of seeming too circumstantial and repeating what I have already said, I will now summarize and further emphasize what can be done in this matter

The prospect of attaining permanent results is first and foremost dependent on an early diagnosis Stomach trouble in patients of or above middle age, however slight it may be, should never be neglected but should always be the object of careful examination particularly by X-raying

In addition to repeated X-ray controls, gastrosocopy should if possible be employed in all doubtful cases

Chronic stomach ulcers particularly callous ones, should be under constant control and undergo operation at an early stage

The same applies in the main, to chronic, hyperplastic gastritis

Polyps should always be suspected of malignancy and when they do not once become the object of an operation, should be subjected to particularly sharp control

"Ulcer prevention and ulcer cure are part of cancer prevention and cancer cure" (BROODGOOD)

The public ought to be enlightened by means of lectures, radio talks and written works as to the symptoms and the insidious appearance of stomach cancer People should be advised to consult a doctor early even for slight stomach trouble

The operation should be performed as radically as possible It is earnestly to be hoped that the future will see us with more perfect means to employ in the fight against stomach cancer Until then we have only to make the very best use of the means we already possess Something can, at any rate, be done with them

### Summary.

The author gives an account of the cases of cancer ventriculi where he performed resection or gastrectomy and which he had the opportunity of following up with after-investigation The number is about fifty The primary operation mortality in the resections amounts to about 9 %, in the gastrectomies to 50 %. Owing to the small number of cases these figures are of little statistical value One year after operation 54 % were alive, after two years 24 % and after four years 10 % The author points out the extremely great importance of an early diagnosis *Sto-*

mach trouble in patients of or above middle age must never be neglected. Chronic stomach ulcers should be under constant control and operated on in time. The operation must be performed as radically as possible.

### Zusammenfassung.

Der Verf. berichtet über die Fälle von cancer ventriculi, wo er Resektion oder Gastrectomie gemacht hat und welche nachuntersucht worden sind. Die primäre Operationsmortalität der Resektionen beträgt etw. 9 %, die der Gastrectomien 50 %. Die Zahlen sind ja wegen ihrer geringen Anzahl von wenig Wert aus statistischem Gesichtspunkt. Ein Jahr nach der Op. lebte 54 %, nach zwei Jahren 24 % und nach vier Jahren 10 %. Der Verfasser hebt den grossen Gewicht der Frühdiagnose hervor. Magenbeschwerden bei Patienten von mittlerem Alter oder älter dürfen nie vernachlässigt werden. Kallose Magengeschwüre sollen konstant kontrolliert und früh operiert werden. Die Operation soll so radikal wie möglich sein.

### Résumé.

L'auteur rend compte d'une cinquantaine de cas de cancer de l'estomac choisis parmi ceux qu'il a traités, dans lesquels on a pratiqué la résection ou la gastrectomie et qu'il a eu la possibilité de réexaminer postérieurement à l'opération. Dans les cas de résection, la mortalité atteignit 9 % et 50 % après gastrectomie. Le nombre limité des cas diminue beaucoup la valeur des chiffres au point de vue statistique. Survie d'un an dans 54 % des cas, de deux ans dans 24 % et de 4 ans dans 10 % des cas. L'auteur souligne l'extrême importance du diagnostic précoce. Il ne faut jamais prendre à la légère des troubles gastriques à partir de l'âge moyen de la vie. Il faut contrôler les ulcères chroniques de l'estomac de façon permanente et les opérer à temps. L'opération doit être aussi radicale que possible.

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From Ludvika Hospital  
(Head HERMAN WAHREN, M D)

## A Case of Habitual Luxation of Capitulum Radii.

By

HERMAN WAHREN, M D

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Dislocations of capitulum radii are not common. Isolated instances of luxation of the proximal end of the radius in children are well known, however, and were already described by DU VERNAY (1751). In older literature they are known under the name of "pronation douloureuse". Descriptions have been given of isolated cases of luxation of the head of radius in adults, but they are extremely rare. In connection with fractured shaft of ulna, luxation of the head of radius (fracture Monteggia) is found in adults as a typical injury.

In anatomical respects luxation of radius in adults appears to have been caused in most instances by the proximal end of radius having been violently dislocated anteriorly by a contraction of the biceps tendon, attended by the entire or partial rupture of that part of the articular capsule which is called ligamentum annulare radii. In children, as is well known, luxation is caused by a forced pulling of the arm in its longitudinal direction. Inveterate or recurrent luxations may depend, either on their not having been observed and treated from the beginning — a thing which is not unusual in the case of children — or on it having been found impossible, after reposition, to retain the head of radius securely in its correct position. These patients usually complain of obstructed and painful pronation and supination and, sometimes, restricted capability of flexion of the lower arm.

Respecting the treatment of these inveterate conditions of luxation, we have to choose between operative treatment and a purely conservative one, which latter, in the case of young patients, seems to have given fairly favourable results. The operative

treatment may consist of a resection of the proximal end of radius, or a plastic reparation of ligamentum annulare radii may be carried out, whereby the head of radius is fixed in the correct position. We see from the literature (MULLER, SOMMER, BUZBY, WILSON, LEWIS and THIBODEAU) that resection of radius is unsuitable in the case of growing persons, as, later on, there may arise considerable disturbances in the position of the hand. In individuals who have attained full growth, this method gives fairly good results, however. Satisfactory results have also been reported after plastic replacement of ligamentum annulare radii (WILSON, SPEED and BOYD, LOTSCH).

A rare variant of luxation in the elbow-joint is the habitual luxation of the radius head. Such a case may be of interest especially perhaps, on account of the method of operation employed, which permits of an extensive exposure both of the cubital parts of radius and ulna, and of the anterior side of the elbow-joint.

*K. S.* age 18. In 1935, attended at another hospital on account of fracture Monteggia. The ulna-fracture, which was complicated, was consolidated. After two months the luxation of capitulum radii was reduced and ligamentum annulare was sewn. About six months ago, the patient received a blow across the right elbow-joint from a board. Since then the arm has incessantly "become locked" when the patient tries to lift heavy objects. This happens when the arm is bent at right angles. By twisting the arm, it becomes moveable again. Sharp pain is felt in connection with the locking. It is now difficult for the patient to work, his arm feels weak.

*Status.* Slight atrophy of the musculature, both of the upper and the lower right arm. The difference in compass is about 2 cm., both for the upper arm and for the lower arm.

*Right elbow-joint.* Full extension. Flexion restricted about 10° as compared with the left. Supination and pronation are, normally, alike on both sides. Crepitations in the joint on movement.

*Roentgen.* Subluxation-position of head of radius. Marks of old, correctly healed fracture of the ulna-shaft.

*Epicrisis.* Here we have a case of subluxation of the right capitulum radii, which, on exertion, is transformed into complete luxation, and causes the patient momentary pains.

*Operation.* (Author) Exposure of the cubital ends of ulna and radius, together with plastic replacement of ligamentum annulare radii. Incision according to BOYD continuing about 12 cm. down the lower arm. Subperiosteal exposure of ulna, membrana interossea, the anterior part of the elbow-joint, together with collum et capitulum radii.

It was now possible to study the position of the cubital end of radius. Capitulum radii was found to be subluxated against the lateral condyle and, by drawing the biceps tendon it could be fully luxated without any difficulty. It was considered that it ought to be possible to counteract this luxation effectively by repairing the ligamentum anulare, and so a new ligament was constructed out of fascia lata, and two holes were bored in ulna. The strip of fascia was then drawn around capitulum radii, and through the holes in ulna. The holes had been bored through the cubital dorsal part of ulna in order to secure, as far as possible, a dorsal fixation of capitulum radii.

Subsequent course without remark. The patient has been working in the woods for several months.

The undertaking of an operative exposure of the cubital part of the lower arm is a grave responsibility, especially when we consider the injury to *n. radialis* which may result.

An excellent method for the exposition of the proximal part of the lower arm is described by BOYD, and I have employed it occasionally. A somewhat more detailed account of it is given here, as it deserves to be more widely known.

The incision begins on the lateral side, a few cm. proximally of olecranon, and then continues along the edge of ulna and, if necessary, all the way down to *processus styloideus*. The edge of ulna is exposed subperiosteally. On the anterior, radial side of the incision, we have then, consequently, *m. anconeus* and *extensor carpi ulnaris*. On the ulnar side we have, farthest proximally, the *triceps* tendon, *flexor carpi ulnaris*, and *flexor digitorum profundus*. By careful subperiosteal dissection, the surface of ulna is laid free, and the operation is continued in the same way past *membrana interossea*. The deep fibres from the *supinator* are divided close to ulna. The preparation is continued over *radius* and over the anterior side of the joint. The *extensor* musculature can be drawn back with the help of broad hooks, so that good access can be gained to the proximal parts of ulna and radius, and to the anterior side of the joint. The deep branch of *nervus radialis* is not adventured by this procedure, being separated all the time from the operation area by *musculus supinator*. If necessary, *arteria interossea* can be ligated.

### Summary.

A case is described of recurrent luxation of the radius head in a youth of 18, and an account is given of the method of operation employed.

### Zusammenfassung.

Es wird ein Fall von wiederholter Luxation des Radiuskopfes bei einem jugendlichen Kranken von 18 Jahren beschrieben und über die verwendete Operationsmethode berichtet

### Résumé.

Description d'un cas de luxation récurrente de la tête du radius chez un jeune malade de 18 ans et du procédé opératoire utilisé

### Literature

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## Die Rolle der mikroskopischen Arterien, speziell der Kapillaren, bei der Entwicklung eines Kollateralkreislaufs.

Von  
THORE OLOVSON

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Die Blockierung einer Arterienbahn bedeutet, gleichgültig, ob sie rasch oder langsam erfolgt, eine durchgreifende morphologische Umorganisation der arteriellen Gefässversorgung in dem betroffenen Gebiet. Gewisse der blockierten Bahnen erfahren eine vollige oder teilweise Rückbildung, andere, an die gesteigerte funktionelle Anforderungen gestellt werden, passen sich dem an und erleiden Veränderungen in Bezug auf Weite, Länge und Form.

Entscheidend für den Ausgang ist indessen die Beschaffenheit derjenigen Bahnen, welche das Verbindungsglied zwischen den verschiedenen Gefässsystemen des Kollateralkreislaufs bilden, nämlich der Anastomosen. Sind diese gross und zahlreich genug, und besitzen sie die Fähigkeit, sich rasch anzupassen, dann ist der Umfang der Kreislaufstörung ein geringer oder sie bleibt ganz aus. Im entgegengesetzten Fall kommt es zu einer Beschränkung der Blutzufuhr, welche sich durch eine funktionelle Insuffizienz oder, bei hochgradigem Blutmangel, durch Zerstörung von Gewebe bemerkbar macht.

Nach der alten, klassischen Anschauung (HALLER 1762, MURRAY 1798, TIDEMANN 1822 u. a.) sollen die Arterien mit zahlreichen groben, mit blossen Auge sichtbaren Anastomosen ausgestattet sein. Jüngere Forscher (LERICHE 1922, RASSAT 1922, MASSÉ 1925) sind zu der entgegengesetzten Ansicht gelangt, nämlich dass makroskopische Anastomosen ganz fehlen oder wenigstens sehr selten seien. Neuere Untersuchungen (OLOVSON 1941) über die Verbindungen zwischen Arterien des Beckens und Ober-

schenkels haben ergeben, dass sowohl beim Menschen wie beim Kaninchen makroskopische Anastomosen in dieser Region keineswegs selten, sondern im Gegenteil ziemlich häufig sind. Die individuellen Variationen sind jedoch gross. Dass die Anastomosen zwischen den Arterioli, Prakapillaren und Kapillaren der mikroskopischen Bahnen besonders reichlich entwickelt sind, ist wohl bekannt. Da der Gesamtquerschnitt dieser feinen Bahnen seiner Grosse nach den der groberen wesentlich übersteigt, besteht Grund zu der Annahme, dass diese feineren Bahnen rein quantitativ bei der Wiederherstellung der Zirkulation durch einen Kollateralkreislauf eine wichtige Rolle spielen können. Immerhin sind die Ansichten über die Bedeutung dieser feineren Bahnen für den Kollateralkreislauf sehr wechselnd. LERICHE und seine Schule, welche nicht mit dem Vorkommen makroskopischer Verbindungsbahnen rechnen, stehen folglich auf dem Standpunkt, dass die mikroskopischen Anastomosen die Hauptrolle spielen. LERICHE sagt »Macroscopiquement le système artériel n'est guère anastomotique, on est donc conduit à supposer que c'est surtout par la mise en jeu d'anastomoses artériolaires non injectables et non disséquables, pour la plupart intramusculaire, que la circulation se rétablit« SPALTENHOLZ (1937) ist der entgegengesetzten Ansicht. Er hält die mikroskopischen Anastomosen in der Muskulatur, welche das wichtigste Kollateralbahnen vermittelnde Gewebe ist, für zu fein, als dass ihnen irgendeine grossere Bedeutung als Gefässverbindungen beim Kollateralkreislauf zukommen könnte. »Die Anastomosen in einem Muskel zwischen Ästen verschiedener oder derselben Arterie sind alle sehr fein im Verhältnis zu den Hauptstämmen, sind also nicht geeignet bei plötzlichem Verschluss eines derselben dessen Gebiet mit zu versorgen« (SPALTENHOLZ).

Es gibt Untersuchungen, wo man auf experimentellem Wege die Rolle der feinen Bahnen zu klären versucht hat. Durch Unterbindung oder künstliche Embolien blockierte IWANOW eine Anzahl von groberen Arterienbahnen (beim Hunde). Der Kreislauf durch die übrigen feineren Bahnen erwies sich als ungenügend. IWANOW (1928) sagt »Die Ausschaltung einer bestimmten Anzahl grosser Arterien aus dem System schafft ein Hindernis auch für die normale Funktion der Kapillaren und der Prakapillaren dieser Gegend« PEARSE (1928) und DOLGO-SABUROFF (1931) nahmen in derselben Absicht wie IWANOW weitreichende Exzisionen von Hauptarterien der Extremitäten bei Hunden vor. In so gut wie sämtlichen Fällen fanden diese Autoren, dass der Kreislauf ohne

Eintreten einer Gangian wiederhergestellt wurde Die beiden Forscher erkennen demgemäss den feineren Bahnen eine grosse funktionelle, kompensatorische Kapazität zu

Unter den feineren Bahnen sind es namentlich die Kapillaren, welche reich entwickelte Anastomosen aufweisen In dem Masse, wie sich die Kapillaren an der Entwicklung eines Kollateralkreislaufs beteiligen, mussten auch sie erwartungsgemäss eine kompensatorische Entwicklung erfahren Dies ist die Frage, welche ich in der vorliegenden Arbeit zum Gegenstand der Untersuchung gemacht habe Der Ausgangspunkt war hierbei der, dass sich eine Beteiligung der Kapillaren an der kompensatorischen Entwicklung durch eine gesteigerte Blutansammlung oder eine vermehrte Kapillarendichte zu erkennen geben musste Meine Aufgabe war also der Versuch, diese etwaige kompensatorische Entwicklung der Kapillaren durch eine quantitative Bestimmung der Gesamtanzahl Kapillaren pro Flächeneinheit in gewissen Muskeln, die als vermittelnde Transportwege für einen künstlich bewirkten Kollateralkreislauf dienen, zu demonstrieren Diese Frage schliesst auch das wichtige Problem der Bildung ganz neuer Bahnen beim Kollateralkreislauf in sich ein

Im allgemeinen werden bei der Entwicklung eines Kollateralkreislaufs hauptsächlich praexistente Bahnen ausgenutzt Man rechnet jedoch allgemein damit, dass auch eine Bildung ganz neuer Bahnen stattfindet Irgendwelche sicheren Beweise dafür, dass dies der Fall ist, liegen, soweit ich im Schrifttum finden konnte, nicht vor Durch Untersuchungen von PETRÉN, SJÖSTRAND und SYLVÉN wissen wir, dass bei gesteigerter funktioneller Inanspruchnahme in der Heiz- und Skelettmuskulatur eine Neubildung von Kapillaren erfolgt Sofern man annehmen will, dass sich auch die kleinsten Bahnen, die Kapillaren, als Transportwege am Kollateralkreislauf beteiligen, muss man offenbar mit einer Neubildung solcher unter diesen Umständen rechnen Dieses Problem der Neubildung von Kapillaren hängt demgemäss mit der Frage zusammen, ob diese feinsten Bahnen, in erster Linie im Dienste des Stoffwechsels, überhaupt als Organe der Zu- und Abfuhr an einem Kollateralkreislauf teilnehmen

### *Material und Technik*

Die Untersuchung wurde an Kaninchen etwa desselben Alters ausgeführt Gewicht und Geschlecht der Tiere werden aus der Tabelle ersichtlich In sämtlichen Fällen wurde durch doppelte

Unterbindung der A femoralis am rechten Femur ein Kollateralkreislauf erzeugt. Die Unterbindungsstelle war stets die gleiche, nämlich unmittelbar unterhalb der Abzweigung der A profunda femoris und der Aa circumflexae femoris. Hierbei müssen die besagten Arterien, die A profunda femoris und die Aa circumflexae femoris, die Hauptwege des neu gebildeten Kollateralkreislaufs werden (OLOVSON). Die Anastomosen für den Kollateralkreislauf liegen hauptsächlich in der Muskulatur auf der Innenseite (Mm adductores) und auf der Vorderseite (Mm vasti). Der andere Oberschenkel, an dem kein Eingriff vorgenommen worden war, diente als Kontrolle. Zeichen einer Kreislaufstörung in Form von Gangrän oder Atrophie wurden nie beobachtet. Eine Infektion der Operationswunde kam nicht vor. 14 Tage nach der Operation wurden die Tiere durch intravenöse Injektion von 3–4 mg Histamin getötet. Hierbei entsteht ein typischer Shock, und die Tiere sterben nach einigen Minuten. Mit dieser Tötungsart wurde beabsichtigt, sämtliche Kapillaren durch das Histamin zur Öffnung zu bringen (LINDGREN 1934, SJOSTRAND 1934) und demzufolge bei der quantitativen Bestimmung die Gesamtzahl der Kapillaren pro Flächeneinheit ermitteln zu können.

Unmittelbar nach dem Tode der Tiere wurden Stücke aus genau derselben Partie korrespondierender Muskeln an beiden Oberschenkeln exzidiert. Diese Muskelstückchen wurden dann gefroren, entwässert und getrocknet, gemäss der von F und T SJOSTRAND (1938) angegebenen Methodik, die Schnitte wurden nach dem Verfahren von T SJOSTRAND (1934) gefärbt. Im Schnitt werden die Kapillaren durch die in ihnen befindlichen, gefärbten Blutkörperchen sichtbar. Die Anzahl der Kapillaren pro Flächeneinheit der 20  $\mu$  dicken Querschnitte durch die Muskulatur wurde durch Auszählen von 25 mittels eines Okularmikrometers abgegrenzten Feldern von 0,04 mm<sup>2</sup> ermittelt. An Hand der so erhaltenen Werte wurde die Zahl der Kapillaren pro mm<sup>2</sup> bestimmt.

Die Untersuchungsergebnisse sind in der folgenden Tabelle gesammelt. Diese enthält die gefundenen Werte für die Anzahl der Kapillaren sowohl auf der unterbundenen wie auf der nicht unterbundenen, normalen Seite. Die untersuchten Muskeln sind in der Tabelle folgendermassen mit Buchstaben bezeichnet: A = M sartorius, B = M adductor longus und C = M rectus femoris (Caput longum). Die korrespondierenden Muskeln auf der nicht unterbundenen Seite sind mit A<sub>1</sub>, B<sub>1</sub> und C<sub>1</sub> bezeichnet.

Jeder in der Tabelle enthaltene Wert ist das Resultat von 25 Bestimmungen der Kapillarenzahl in jedem untersuchten Muskel. Für jeden Wert wurde der mittlere Fehler berechnet.

Tier Nr	Geschlecht	Gewicht kg	Unterbundene Seite			Nicht unterbundene Seite		
			A	B	C	A <sub>1</sub>	B <sub>1</sub>	C <sub>1</sub>
1	♂	2	1672±42	1336±39	1608±48	1652±39	1427±35	2392±56
2		1,5	1792±33	1089±21	1722±25	1061±24	1017±20	1098±22
3		2,2	1286±25	1174±27	1626±42	2100±35	1240±25	1701±37
4		2	1719±38	1253±31	1804±26	1839±23	1403±23	2068±22
5		2	2201±54	1461±25	2606±26	2791±31	1511±28	2036±32
6		2,3	1786±30	1801±30	2837±40	2162±32	1408±27	2581±35
7		2,1	1674±29	2788±43	2331±37	2021±29	2279±48	2357±41
8		1,1	2510±31	1588±48	2330±29	2159±39	1337±16	2163±53
9		1	2299±33	2169±26	3013±48	2041±31	2207±54	2339±42
10		1,7	2129±31	1420±24	2561±51	1750±34	1356±36	1781±39
Mittel			1907±116	1608±165	2244±164	1958±139	1518±129	2052±116

Aus den gefundenen Werten geht hervor, dass die Zahl der Kapillaren in den untersuchten Muskeln ziemlich stark schwankt, und zwar sowohl auf der unterbundenen wie auf der nicht unterbundenen Seite. Ein merkbares Übergewicht der Werte auf der unterbundenen Seite, wie man es etwa hatte erwarten können, kommt nicht vor. In nicht ganz wenigen Fällen ist die Kapillarenzahl auf der nicht unterbundenen, normalen Seite grösser, z. B. 5 A<sub>1</sub>, 1 C<sub>1</sub> u. a. m. Für die Werte der einzelnen Muskeln wurden die Mittel berechnet, und man findet diese in der untersten Zeile der Tabelle. Diese mittleren Werte machen ersichtlich, dass die Zahl der Kapillaren im Muskel A<sub>1</sub>, also auf der nicht unterbundenen Seite, etwas höher ist als im Muskel A, dem der anderen, operierten Seite. In den beiden anderen Muskeln überwiegen die Kapillaren auf der unterbundenen Seite ein wenig. Der Unterschied ist jedoch ziemlich klein und hält sich in den Grenzen der mittleren Fehler. Ein statistisch bewiesenes Übergewicht der Kapillarenzahl auf der unterbundenen Seite besteht mithin nicht.

Die Untersuchung hat somit ergeben, dass sich die Kapillaren während der Entwicklung eines Kollateralkreislaufs ziemlich passiv verhalten. Die Anzahl der Kapillaren auf der unterbundenen und der nicht unterbundenen Seite ist einigermassen die gleiche. Das Untersuchungsergebnis ist also, dass eine kompensatorische Reaktion in Form einer gesteigerten Blutzufuhr auf dem Wege über die Kapillaren oder in Gestalt einer Zunahme der Zahl die-

ser nicht stattzufinden scheint. Die allgemeine kompensatorische Entwicklung, welche das Gefäßsystem in einer bestimmten Gegend während der Ausbildung eines Kollateralkreislaufs erfährt, erstreckt sich offenbar nicht auf die Kapillaren.

### Zusammenfassung.

Unter den feineren Arterienbahnen besitzen namentlich die Kapillaren ein reich entwickelte Anastomosen-system. Nach Messung der Beteiligung der Kapillaren an der Entwicklung eines Kollateralkreislaufs ist zu erwarten, dass die Kapillaren ebenfalls einen kompensatorischen Ausbau erfahren, der in einer vermehrten Blutansammlung oder in einer dichteren Schärung der Kapillaren zum Ausdruck kommen würde. Verf. hat versucht diese kompensatorische Entwicklung durch quantitative Bestimmung der Gesamtzahl der Kapillaren in gewissen Muskeln, deren Gefäße sich am Zustandekommen des Kollateralkreislaufs beteiligen, des näheren zu ergründen. Die Untersuchung wurde an Kaninchen bewerkstelligt, bei denen die Arteria femoralis auf der einen Seite unterbunden worden war. Nach zwei Wochen wurden die Tiere getötet, worauf die Kapillarenzahl in korrespondierenden Muskeln der unterbundenen und der nicht unterbundenen Seite bestimmt wurde.

Die festgestellten Werte machen ersichtlich, dass die Anzahl der Kapillaren in den untersuchten Muskeln ziemlich stark schwankt. Ein deutliches statistisch sicheres Übergewicht der Werte für die unterbundene Seite ergab sich indessen nicht. Aus der Untersuchung geht somit hervor, dass sich die Kapillaren nicht an der kompensatorischen Entwicklung zu beteiligen scheinen, welche die übrigen Gefäße in einer bestimmten Region beim Zustandekommen eines Kollateralkreislaufs durchmachen.

### Summary.

Among the courses of the finer arteries it is the capillaries especially which have a richly developed anastomotic system. In the measure which the capillaries participate in the process of collateral circulation one might well expect that these also should be subjected to a compensatory evolution which should make itself manifest by an increase in the density of the capillaries. The author has endeavoured to establish the compensatory evo-

lution of the capillaries by means of a quantitative count of the total number of capillaries in certain muscles, the vessels of which participate in the process of collateral circulation Rabbits have been used for experimental purposes in which the femoral artery has been ligatured on one side After two weeks the animal has been killed whereupon the number of capillaries has been determined in the corresponding muscles on both the ligatured and the unligatured side

From the amounts discovered it appears that the number of capillaries in the examined muscles vary considerably No tangible, statistically positive excess in number on the ligatured side, however, was found It therefore seems, from the investigation, that the capillaries do not appear to participate in the compensatory evolution which the vessels within a certain region otherwise undergo during the process of a collateral circulation

### Résumé.

Parmi les vaisseaux artériels de petit calibre, ce sont surtout les capillaires qui ont un système d'anastomoses abondamment développé Dans la mesure où les capillaires prennent part au développement de la circulation collatérale, il faut s'attendre à les voir subir un développement compensatoire se manifestant par une accumulation du sang ou une densité accrue du réseau capillaire L'auteur a cherché à déterminer ce développement compensatoire des capillaires en déterminant le nombre total des capillaires dans certains muscles dont les vaisseaux participent au développement d'une circulation collatérale Comme animaux d'expérience, il a utilisé des lapins sur lesquels il a pratiqué la ligature de la fémorale d'un côté L'animal a été sacrifié au bout de deux semaines, après quoi le nombre des capillaires a été déterminé dans des muscles correspondants du côté de la ligature et de l'autre côté

Des chiffres trouvés il résulte que le nombre des capillaires dans les muscles examinés présente des variations extrêmes Il a cependant été impossible de démontrer une augmentation du nombre des capillaires appuyée par la statistique, du côté de la ligature Il résulte donc des recherches faites que les capillaires ne semblent pas prendre part au développement compensatoire que subissent les vaisseaux d'une certaine région dans le développement d'une circulation collatérale

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*Treatment of  
Thrombophlebitis  
and  
Pulmonary embolism  
with*

**HEPARIN**

the physiological  
anticoagulant

STOCKHOLM, SWEDEN

# HEPARIN

## FOR THE TREATMENT OF THROMBO-EMBOLISM

During the last five years heparin treatment has been extensively used in Sweden in cases with deep venous thrombosis and with pulmonary embolism. In consequence of this, the course of the disease has been entirely changed. Due to the specific therapy, the mortality in a series of 600 cases of deep venous thrombosis, many of them with pulmonary embolism, has dropped from 15 per cent in earlier surgical series and 5 per cent in gynecological series to less than 1 per cent. The stay in bed due to the thrombosis has been shortened from an average of 7 weeks to less than one week. Repeated pulmonary emboli do not occur. The sequelae following phlegmasia alba dolens, such as leg indurations and leg ulcers, are not nearly so prominent as in untreated cases.

**Heparin treatment** is indicated in every case of deep venous leg thrombosis and of pulmonary embolism at least as an initial measure. It is of vital importance, for instance, in acute thrombosis of the deep veins of the calf, that the growth of the thrombus should be checked and its further progression to the popliteal and the deep femoral vein prevented. Only heparin gives the immediate reliable effect necessary to stop the further progress of the thrombosis. It can for this purpose not be replaced by dicoumarol. Heparin is of particular value in vascular surgery. Cases of mesenteric vein thrombosis, retinal thrombosis and cerebral thrombosis and embolism have been successfully treated with heparin. The anticoagulant should also be administered if a latent thrombosis is suspected, e.g. post partum or in pneumonia with signs of infarction and a fever resistant to treatment with sulphur drugs.

Prophylactic heparin treatment is given postoperatively and post partum to patients who have earlier suffered from thrombo-embolism.

The intravenous drip infusion of glucose, sodium chloride or penicillin solutions is facilitated through the addition of heparin.

**The dosage of heparin.** The first dose, 150 mg of heparin of standard potency is given as soon as the condition has been diagnosed, preferably already in the patient's home before he is sent to the hospital. After 4—5 hours a similar dose is given. During the first two days, up to 450 mg can be administered daily (3 doses of 150 mg each, or 4 doses of 125, 100, 100 and 125 mg). In the case of severe pulmonary embolism heparin is given in conjunction with proper vein drainage. During the next days the dosage should be adjusted according to the course of the illness, due attention being paid to temperature, swelling, tenderness and pains in the leg. The treatment with anticoagulants should not be discontinued before the patient gets up.

**Movement therapy.** Under the influence of heparin the larger veins remain free of fragile clots. Hence active movements are allowed. Because of their beneficial influence movements are started on the first or second day and are steadily increased from day to day. The patient leaves his bed early. The hospital care of thrombotic patients is hereby greatly facilitated.

*Heparin I utrum is the first commercial brand of pure heparin. It is available at a low price.*  
*For intravenous use: 5 ml 5 per cent sterile solution.*  
*For blood analysis and animal experiments: 5 ml 1 per cent sterile solution.*

From the Department of Surgery of the University of Upsala  
(Surgeon in-Chief Professor OLLE HULTÉN)

## Perforation as the First Sign of Cancer in the Large Intestine in Young Patients.

By

THORSTEN HENDELBERG

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When considering the differential diagnostic possibilities in a case of acute peritonitis in an effort to determine the origin of the inflammation, a thorough study is usually made of the anamnesis and the symptom picture in order to find evidence of a primary disease of the organs most often the sites of inflammatory processes the appendix, the bile passages, the female genitals, the pancreas, Meckel's diverticulum, the small intestine and its mesenteric glands, and, in the case of perforative peritonitis, the stomach and the duodenum, the most common primary foci. In older patients, in what is known as the cancer age, the possibility is of course also considered of the inflammatory process being due to an ulcerated and perforating cancer, especially one situated in the large intestine, which not seldom gives rise to perforative peritonitis. In the case of young people, however, one is apt to forget or at least pay little attention to this possibility, which oversight may seem justified since cancer is much less common in the lower age groups. During the past five years, we at the Department of Surgery of the University of Upsala have had five cases of cancer of the large intestine in young patients, in which there was perforation either to the peritoneum with peritonitis as a result or to the soft parts around the rectum with periproctitis and anal fistulas as a result, both as the very first or one of the first symptoms, in all the cases this symptom led to confusion and delay in making the correct diagnosis. In four of the cases the cancer was situated in the rectum and in

one case in the descending colon. Very little attention has been paid in the literature to this cause of peritonitis and to this complication of cancer in the large intestine, and even in the more important handbooks it is either ignored or else mentioned as an exceedingly rare occurrence.

Cancer of the rectum in young people is by no means extraordinary, or even rare. MAYO and GORDON (1940) published 116 cases of cancer of the rectum in patients under thirty years. These cases constituted 3.4 percent of the total number of cases of cancer of the rectum treated at the Mayo Clinic from 1910 to 1933. LAIRD (1941) collected, in addition to one case of his own, 18 cases of cancer of the colon in patients under fifteen years. STEBBINS and BURKE (1937) reported on three patients under twenty years in a series of 265 cases of cancer of the rectum. NEUMANN (1940) and HRDLICKA (1941) both reported the frequency to be 2 to 4 percent, which corresponds closely with the frequency in our series, which amounted to 3.4 percent for cancer of the large intestine in patients under 35 years. In a series of 100 cases of cancer of the rectum at the Mayo Clinic, 7 percent of the patients were under 30 years and 17 percent were under 36 years (RANKIN and COMFORT). NEUMANN's cancer series (1940) included 17 patients under 30 years, three of whom had cancer of the rectum, and ROSSER and KERR (1939), who published 112 cases of cancer in patients under 26 years, found that cancer of the rectum formed the largest group with 21 cases. Thus the rectum seems to be the most common site of cancer in the young.

Cancer in the young is generally believed to be more malignant than in older people. BUIRGE (1942) was unable to observe any difference in malignancy in the case of cancer of the rectum. However, six of HRDLICKA's seven cases were inoperable, as were both SCHMINCKE's two cases under 20 years, and OPPOLZER and NITSCHKE (1942) had more recurrences and poorer three-year results among young patients. According to HART (1941) and MAYO and GORDON (1940), radical operation is feasible in 30 to 60 percent of older patients. Consequently there seems to be no doubt that the prognosis is considerably less favorable and the malignancy is greater in the young. It is therefore all the more important that the diagnosis be made at as early a stage as possible.

The symptomatology of cancer in the young is not discussed in any detail in the literature. The first symptom of cancer of the rectum in older people is often defecation disturbances with

bloody, mucous stools The site of the tumor plays a certain part in the symptom picture When the tumor originates in the ampulla of the rectum, in which case it is generally of the adenocarcinoma type with early central ulceration, the patient is troubled by frequency of defecation, he has to get up earlier in the morning to defecate or defecates before breakfast, and finally when the stage of diarrhea is reached or the stools consist only of bloody mucus, he has to defecate every time he urinates Not until the tumor has become circular and constricts the ampulla, do passage difficulties arise, if the ampulla is wide this process takes at least a year, according to DAVID, whose presentation of the symptomatology I have mainly followed Discomfort to the patient with a cancer with the site in question first takes the form of tenesmus and a vague sensation of fullness of the rectum Not until the tumor has penetrated to the surrounding tissue does the patient begin to suffer real pain, often along the great sciatic nerve with penetration to the sacrum or with penetration to and infection of the ischio-rectal fossa with periproctitis, anal abscess or fistular formation With penetration to the bladder, and prostate, the patient has difficulty with urination However, if the cancer is situated in the region of the sphincter, pain is felt at an early stage due to spasm of the sphincter, bleeding in connection with defecation also is seen at an early stage, irrespective of whether the stools are loose or firm If the cancer is situated in the upper part of the rectum at the transition to the sigmoid flexure, it is often of a more scirrhus type and soon gives rise to a stricture As a result the symptom picture in these cases is often more like cancer of the colon with passage difficulties loose stools alternating with firm, diarrhea and constipation, possibly with the passage of pencil-thick stools or stools resembling sheep excrement

DAVID stated that fistulas and peritoneal lesions both are late signs, and that the latter are very rare, which is not surprising since 60 to 75 percent of the tumors are said to be situated in the portion of the rectal ampulla which is distal to the floor of DOUGLAS's cul-de-sac, and only 20 percent in the region between the rectum and the sigmoid flexure, in only 1 percent is the anus involved

The syndromes in the cases of rectal cancer in young people observed during the past five years at the Department of Surgery of the University of Upsala all differed considerably from the usual symptom pictures just described

*Case 1* A man of 22 years suddenly fell ill while working in the fields. He had violent abdominal pain, and on admission a few hours later he showed signs of perforative peritonitis. Roentgen examination showed no free gas, but a free exudate was seen around a gas-containing section of the intestine below the stomach. Operation was done immediately, revealing a purulent peritonitis, with an uncertain primary site. The appendix and Meckel's diverticulum, which, like the whole of the small intestine, were inflamed, were removed. Microscopic examination of Meckel's diverticulum provided no explanation of the peritonitis. Marked eosinophilia in this tissue provided evidence in support of the diagnosis, regional ileitis, possibly of allergic type. Two weeks later a lump was palpated in Douglas's cul-de-sac, which was punctured and drained. Three weeks after the operation the patient was discharged free from symptoms. During the next two months the patient returned twice for recurrence of the pain, which on both occasions was diagnosed as exacerbation of the abscess in Douglas's cul-de-sac accompanied by mild subileus. Both attacks passed over quickly. Four months after the operation bloody stools were passed, and there were slight symptoms of subileus on one occasion. Roentgen examination revealed no obstruction, however, and the patient returned to work. When a year had passed since the operation the patient began to pass bloody stools six or seven times a day, and two months later he was admitted complaining of severe colicky abdominal pain and with slight subileus. The possibility of a tumor was now mentioned for the first time in the record. Exploratory laparotomy revealed a disintegrating tumor mass in the true pelvis, and histologic examination showed a degenerating adenocarcinoma growing like a papilloma.

*Case 2* A man of 32 years was operated on in 1938 at another hospital for a retrocecal abscess, assumed to have originated in the appendix. Drainage constituted the only treatment. In 1942, while doing his military service, the patient underwent appendectomy, the diagnosis being fibrinopurulent periappendicitis. Obviously a local peritonitis was found around the cecum, although not originating in the appendix. The convalescence was complicated by an abscess in the abdominal wall, and the patient remained in hospital for nine weeks. The following year he began to show signs typical of cancer of the rectum with frequent passage of loose stools. He was treated by a physician for "intestinal catarrh", which diagnosis was not revised even when the patient reported that he had observed blood in the stools. He came to the hospital because of dyspnea, exhaustion and inability to work. He had then been defecating as often as ten times a day for some time. His appetite had been good, however, and he had lost only 4 kg in weight. A ridge-like circumscribed tumor of the consistency of cartilage was palpated above the prostate. On biopsy this tumor was found to be an adenocarcinoma. In connection with colostomy, numerous adhesions to the cecal tract were found on the right side. It was therefore strongly suspected that the local peritonitis, the origin of which could not be determined at the previous operation,

had arisen from a disintegrating cancer of the rectum, not diagnosed until too late. It is not absolutely impossible that the appendicitis abscess of 1938 had recurred in 1942 without the appendix itself necessarily causing the recurrence, but this is rather unlikely, the more so since only one year later the patient showed very advanced cancer of the rectum with pronounced disturbances in defecation. The presence of adhesions to the site of the old abscess and the slow convalescence — nine weeks — after the appendectomy also suggest that the disease is best explained by a single diagnosis, secondary peritonitis arising from cancer of the rectum.

*Case 3* A nurse of 33 years was admitted with no history of gastric ailment. The day before admission she had mild flatulence and passed a loose, but not diarrheal stool. On the day of admission she had a sudden attack of pain in the left side of the abdomen, most intense to the left of the umbilicus. She was nauseated. The temperature was 40° C and the abdomen was tympanitic, distended and diffusely tender, with maximum tenderness in the left side of the iliac fossa, where pronounced muscular rigidity was noted. The white blood count was only 3 000. The condition was interpreted as enteritis and peritonitis and it was decided to wait a few days before operating. However, the patient grew worse, and began to show signs of sepsis, with beginning jaundice. She vomited black, bloody odorless fluid. Exploratory laparotomy was done two days after admission in order to search for the origin of the peritonitis. Since the inflammation was most pronounced on the left side, a left pararectal incision was made. Thick, fetid pus was found between firmly adhesive intestinal loops in the left flank, no free peritoneal cavity was observed. The left iliac fossa was drained. The patient died the next day. Autopsy revealed colonic polyposis with cancerous degeneration and perforation in the descending colon. Metastases were found in the liver.

Thus in all three cases peritonitis constituted the first sign of cancer in the large intestine, and in none of them were we or other physicians able to make the correct diagnosis, even in the cases submitted to exploratory laparotomy, which in one case was done on two occasions. In the third case the liver was already involved, so that the expectant therapy happened by chance to make no difference to the final outcome. But in the first two cases the prognosis would probably not have been too bad if the possibility of a tumor in the colon had been envisaged at the time of the first laparotomies. The peritonitis regressed in both cases, and presumably the inflammation would eventually have subsided to the point where a radical operation could have been done. Following preoperative roentgen treatment palpable tumors often decrease greatly in size or even shrink until they can no longer be palpated, and a great part of this regression is undoubtedly due

at the time due to the intense tenderness of the region, this examination had to be done under general anesthesia at our Department. In Case 4, the presence of a tumor was strongly suspected, but biopsy showed no signs of one. It not seldom happens that the first biopsy gives negative results. This is particularly true of cases with pronounced periproctitis, in which the highly edematous and infiltrated tissue makes it difficult to see exactly where the tumor begins. If the wrong tissue is taken the histologic findings will naturally be incorrect. Not until biopsy is done on tissue from the tumor itself will cancer be discovered. The choice of site in removing a specimen for biopsy is therefore exceedingly important, and in suspicious cases the examiner should not be content with a negative result, but should study tissue from several parts of the area in question.

Common to all five cases is the fact that perforation either to the peritoneum or the periprocttic tissue gave rise to the first sign or signs of cancer. Obviously it is impossible to draw any general conclusions from five cases as to the frequency of cancer perforation or as to the usual course of cancer in the young. Meanwhile, our series of cases of cancer in patients under 35 years for the past five-year period contains only one other case, No. 6. The records show that this patient had two attacks of pain in the upper abdomen, which were so severe that the abdomen was contracted as if by a cramp. The onset of the symptoms was relatively acute, and the patient was feverish. The physician who attended him at home for a few days referred him to us under the diagnosis of pancreatitis, adding that he had noted muscular rigidity in the tender upper left part of the abdomen. On admission, this muscular rigidity was no longer present, but an almost circumscribed tender point, which was even more sensitive to deep palpation, was found to the left of the umbilicus, where there was also percussion tenderness. Roentgen revealed a cancer constricting the sigmoid flexure. There thus seemed to be little doubt that the pain was caused by penetration of the cancer and inflammation of the peritoneum over the tumor. On operation a month later the tumor was found embedded in the omentum, but there was no acute inflammation and no ileus.

It may of course be a coincidence that all the cases of cancer in patients under 35 years admitted during the past five-year period showed early signs of perforation, and this observation should not cause us to generalize. But I think we are justified in mention-

ing this tendency toward perforation in cases of cancer in the young, which perhaps constitutes one of the signs of the greater degree of malignancy generally recognized as characteristic of cancer in the young, the more so since the literature contains only very few reports on the subject

In 1936 FINSTERER reported to *Gesellschaft der Chirurgen* in Vienna on a few cases illustrating the difficulty of differentiating between peritonitis caused by tumor and peritonitis of some other origin KORTE and LERCH published cases with abscess in the abdominal wall as the first sign of cancer of the colon Periproctitis and gluteal abscesses were described by KUTTNER and SCHERK as the first signs, and TUFFIER mentioned intra-abdominal abscesses as the initial manifestation of cancer of the colon For the rest, peritonitis of this origin is regarded as a rarity (DAVID)

After having studied the material collected during the past five years, it seems to me that it should be strongly emphasized that perforation and peritonitis are by no means rare in the cases under discussion Furthermore, I think there is reason to conclude from observations that in cases of perforative peritonitis in young people, too, special attention should be paid to the large intestine, and a careful search should be made for cancer in that organ if no other origin of the peritonitis can be found In the presence of anal fistulas, rectal palpation should always be done, possibly under anesthesia, and if necessary the examination should include rectoscopy and biopsy, which may be done several times if there is any doubt as to the exact site of the tumor If the results of the investigation are negative, the entire large intestine should be examined roentgenographically

### Summary.

A report is given of the six cases of cancer of the colon in patients under 35 years treated during the past five-year period at the Department of Surgery of the University of Upsala Three of these cases showed peritonitis as first sign of cancer In none of the cases were any of the physicians consulted able to make the correct diagnosis in time, this despite the fact that two of the patients were submitted to laparotomy In two cases the tumor penetrated to the periproctitic soft parts with anal fistulas, and here, too, the diagnosis was not made until a late stage The sixth patient had a history of attacks of pain which, in view of the

operative findings, must be interpreted as symptoms of perforation. Although it may be a coincidence that all the cases of cancer of the colon in patients under 35 years treated during the past five-year period showed distinct signs of perforation, it seems reasonable to conclude that cancer of the colon should always be borne in mind as a possible cause of peritonitis of obscure origin in the young, and also that the diagnosis of abscess or fistula to the anus should not be accepted without first making a thorough examination of the rectum. Very few cases of this kind have been described in the literature.

### **Zusammenfassung.**

Veif berichtet über die 6 Fälle von Cancer coli bei Kranken von unter 35 Jahren, die in dem letzten Jahrzehnt in der Chirurgischen Universitätsklinik zu Upsala in Pflege waren. Von ihnen wiesen drei Fälle als erstes Symptom des Krebses Peritonitis auf, und in sämtlichen Fällen konnte die Diagnose von uns oder anderen Ärzten nicht rechtzeitig gestellt werden, in zwei Fällen trotz Vornahme einer Laparotomie. — In zwei Fällen fand die Perforation in periproktitische Weichteile statt mit Entstehung von Analfisteln, und auch in diesen Fällen wurde die Diagnose auf einem späten Stadium gestellt. Der sechste Fall wies in der Vorgeschichte Schmerzanfälle auf, die mit dem Operationsbefund zusammengestellt, als Perforationsschmerzen aufgefasst werden müssen. — Wenn es auch ein Zufall sein kann, dass sämtliche Fälle von Cancer coli bei Kranken von unter 35 Jahren im letzten Jahrzehnt früh Anzeichen einer Perforation aufgewiesen haben, so erscheint es immerhin wohl begründet, auch bei jüngeren Personen mit Peritonitis von unklarer Genese immer an die Diagnose Cancer coli zu denken, wie man sich auch nicht mit der Diagnose Abscessus oder Fistula ad anum zufrieden geben darf, ohne den Mastdarm sorgfältig untersucht zu haben. Das Schrifttum bringt recht spärlich Mitteilungen über Fälle dieser Art.

### **Résumé.**

L'auteur rend compte de 6 cas de cancer du colon chez des malades au-dessous de 35 ans, qui ont été traités pendant les cinq dernières années à la clinique universitaire d'Upsal. Trois d'entre eux présentèrent de la péritonite comme premier symp-

tôme de cancer et, dans tous les cas, ni les medecins de la clinique, ni d'autres medecins ne purent poser à temps le diagnostic, malgré une laparotomie dans deux cas. Dans deux cas, il y eut perforation dans le tissu conjonctif lâche péricolique avec fistules anales, et même dans ces cas le diagnostic fut tardif. Dans les anamnétiques du sixième cas, on relevait l'existence de crises douloureuses qui, rapprochées de l'état des lieux observé lors de l'opération, durent être interprétées comme symptômes de perforation. Bien que ce puisse être l'effet du hasard que tous les cas de cancer chez des malades n'ayant pas atteint 35 ans aient, durant cette période de cinq ans, présenté des signes de perforation précoce, il semble indiqué de penser toujours au diagnostic de cancer du colon même chez de jeunes individus présentant des symptômes de péritonite d'origine obscure, il ne faut pas non plus se contenter du diagnostic d'abcès ou de fistule sans avoir pratiqué un minutieux examen du rectum. La littérature contient très peu de renseignements concernant des cas analogues.

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## Fractures of the Head and Neck of the Radius.

By

ERIK FELTSTROM

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Fractures of the upper end of the radius evaded close study in the period preceding the introduction of X-ray examination. They were therefore often overlooked and were considered to be rather rare. In 1726 PETIT described the first case as a possibility. The first authentic case was found at autopsy by BERARD in 1834. After we had access to X-ray examination, however, these fractures were found to be rather frequent in occurrence, and in larger statistics they are expected to amount to about 1.5 per cent of all bone fractures (ODELBERG-JOHNSON) and about 10 per cent of all fractures in the elbow region (HERTEL).

### Anatomical Relations.

The elbow-joint is made up of three different joints, viz. the *humero-ulnar*, a hinge joint, the *humero-radial* a ball-and-socket joint, and the *proximal radio-ulnar*, a rotary joint.

Of these, the last-mentioned occupies the foreground in this connexion. It is formed by the circular discoid head of the radius and the radial notch in the ulna. The one-centimetric high, fundibular orbicular ligament and the external lateral ligament complete the osteofibrous apparatus that fixes the head of the radius in such manner that the latter can only turn about its own axis. No ligaments of any kind are attached to the head itself.

The articular capsule, which is common to all the three joints, is attached to the radius about 15 millimetres below the joint surface, somewhat more distally on the volar side than on the dorsal, and there forming the small recessus sacciformis. Fractures of the head thus come to lie intracapsularly, fractures of the neck at times extracapsularly. The epiphysis of the radius is calcified

at 5—7 years of age and unites with the diaphysis at 16—20 years. It is circular in circumference with the shaft seated somewhat eccentrically, so that in normal anatomical position, i. e. supination, the dorsal and lateral edge projects bracket-like a little beyond the neck while the internal and volar edge only extends very little beyond it. On pronation, therefore, this backward projecting portion will face forwards when the head rotates  $110^{\circ}$ — $180^{\circ}$  (ODLBERG-JOHNSON). Within this area the osseous structure is also coarser-meshed and more spongy than within the other parts.

That the arm is held in supination may be confirmed on the radiogram by the fact that the tuberosity of the radius then faces forward and inwardly.

The head of the radius has three functions, firstly — and this is the most important one — to perform alone the articulation with the ulna, secondly, in a small degree to take part in the articulation of the forearm with the humerus, thirdly, to take part in the maintenance of the lateral stability of the elbow-joint. An injury to the proximal end of the radius will therefore always involve more or less derangement of these functions, and it will be the articulation with the ulna, i. e. the rotation, which will suffer most as a rule.

### Types of Fracture.

The fractures may be divided according to their appearance into cracks, fractures with very little or no dislocation, fractures with a dislocated fragment, comminuted fractures, separations of the epiphysis, transverse fractures, metaphyseal chisel-fractures, neck fractures, and combination fractures. Different authors subdivide these forms into groups on different principles. HIRTROT, for instance, classes all intra-capsular fractures as head fractures and all fractures between the capsule and the tuberosity of the radius as neck fractures, whereas SPRIED groups the fractures with reference to whether dislocation is present or not, which seems appropriate from the point of view of treatment.

The most common is the simple crack and the longitudinal fracture, the so-called chisel-fracture, which runs from the upper articular surface of the capitulum in the longitudinal direction down towards the collum, the trabeculation being most pronounced in this direction, mostly at a typical point, viz. through the

posterior lateral bracket-like projection. A dislocated fragment that has pushed out to the side often points to an accompanying lesion of the orbicular ligament. In most cases, however, there is only a displacement in the longitudinal direction, and the fragment is then kept pressed against the upper part of the capitulum by the intact ligament. In the comminuted fractures, when the head is split into three or more separate fragments, there is always, if dislocation has occurred, which is also the rule, pronounced injury to the orbicular ligament.

Separations of the epiphysis are not common, but are occasionally seen in children in that the elastic epiphysis gives way (BOHRER, BERGENFELDT, SCHWARTZ, OPPOLZER). Usually the dislocation takes place so that the joint surface of the capitulum comes to face forwards and outwards or entirely outwards. Transverse fractures in adults give a similar picture. They begin internally at a point corresponding to the epiphyseal line and then pass outwardly and distally down into the metaphysis, and are usually wedged. Bordering on the neck fractures are the metaphyseal chisel-fractures in children, which have been described by PHILIPS and GALLAND. The line of fracture there runs vertically from the epiphyseal line and splits off a small piece of the metaphysis. The neck fractures mostly occur in children, but they are also often found in adults. All types may occur from the subcapitular, which are either impacted or more or less dislocated, to types occurring further distally on the border-line to pure shaft fractures with more or less displacement *ad axim*.

Many fractures are accompanied by other injuries. They may, for instance, be associated with a luxation of the forearm or a fracture of the olecranon, coronoid process, or humeral condyles, so-called combination fractures. On account of its course over the neck of the radius the deep ramus of the radial nerve may also be injured in connexion with a fracture within this region. LASSEN describes a case with an inward luxation of the forearm and paresis of the ulnar nerve.

One factor among others determining the form taken by a fracture is the age of the injured person. Neck fractures are the forms most commonly found in the ages 6—17 years, since the elastic cartilaginous parts rather seldom fracture, whereas in the younger age-groups supracondylar fractures of the humerus are most frequent, and in the more advanced age-groups fractures of the head of the radius.

## Etiology.

Fracture of the upper end of the radius may be due to direct or indirect violence. STIMSON considers the most frequent cause to be a direct blow on the elbow, e. g. by a fall on it, while SCUDDER contends that indirect violence, mostly by a fall on the pronated hand with arm extended, is mainly responsible. Cases with forcible rotation or abduction (STIMSON) as the causative element are also described.

ODELBERG-JOHNSON has shown by radiological studies that the upper joint surface of the radial head is in contact with the humeral head in whatever position the forearm happens to be. If the hand is pronated with the forearm subluxed outwardly within the range allowed by the fibrous supporting apparatus, the capitulum humeri will rest immediately in front of the central depression in the radial surface and thus come in close contact with that portion of the circumference which, in this position, projects bracket-like forwards and outwards, whereupon a blow in the longitudinal direction of the radius may produce a fracture of this part. He considers that he has also demonstrated by experiments that fractures of the upper end of the radius cannot arise with the arm supinated. In cases of this kind fracture of the coronoid process of the ulna will arise instead.

Fractures resulting from direct blows to the elbow when the arm is pronated are considered by SKILLERN to be due to the fact that in such a position the edge of the capitulum extends out to the same outer line as the external condyle. The violence can then act directly on the outer edge of the head of the radius, the latter being thereby pressed against the incisura radialis ulnae.

All these factors are more accentuated in cases associated with a concurrent luxation of the forearm or another fracture, and hence fractures of the upper end of the radius are not uncommon complications on such occasions.

The age also determines in some measure the type of fracture that arises in the various types of violence. For instance, while direct violence usually gives rise to fracture of the capitulum in adults it causes fracture of the collum in children. In adults indirect violence results in fracture either of the head or the neck, whereas in children the consequence is a fracture in the weaker area located immediately above the condyles of the humerus.

## Symptoms.

The signs that lead to a suspicion of fracture of the upper end of the radius are

1 *Pains* localized to the outer part of the elbow-joint Further examination shows these to be most intense on pressure over the head of the radius, which is accessible to palpation between the musculus anconaeus and the prominence of the extensor A considerable increase of pain attends the least attempt at rotation, and SCHWARTZ and YOUNG state that on pressure over the head of the radius the pain travels in most cases down to the distal end of the radius, often giving rise to the suspicion that an injury is located there In inveterate cases, however, there is rarely any local tenderness to pressure Furthermore, pain is stated to be less intense if gross dislocation has occurred

2 *Limitation of movement* The subject usually holds the forearm in semiflexion and slight pronation Whereas the power of flexion is very slightly curtailed, that of extension is often reduced especially as regards full range Rotation is the function which proves to be most affected While pronation can be performed to a certain point, the capacity of supination is as a rule entirely abolished both actively and passively, which is quite explicable in view of the anatomical relations In the case of dislocated fractures, however, the mobility is greatly restricted or abolished in all directions In fractures of the collum we can frequently distinctly feel that the capitulum does not join in the rotation of the arm An abnormal power of abduction is occasionally found in these cases (STIMSON)

On account of the thick muscular coverings it is extremely seldom that crepitus or loose fragments can be demonstrated by palpation The latter, however, can now and then be felt as movable bodies on the outside of the biceps tendon Local swelling is an inconstant phenomenon, and haemarthrosis usually arises only in the dislocated varieties of neck fractures

Confirmation of the diagnosis requires, in all cases, careful radiography in two planes at right angles to each other This gives clarity as to what type of fracture is present and whether dislocation has arisen In children, of course, pictures should always be taken of the healthy elbow for purposes of comparison

X-ray examination, however, will now and then fail to give a verdict JUNGHAGEN, for instance, has described two cases that showed normal relations at the first X-ray examination. At a second radiography undertaken after some time a typical chisel-fracture was however revealed, which shows that such may be concealed between the thick trabeculae of cancellous bone if the direction of the ray does not run parallel to the cleft of the fracture. When the radiogram is negative, therefore, this examination ought to be repeated after some time if there is a clinically strong suspicion of fracture.

### Prognosis.

Experience shows that many times the prognosis may be dubious even in mild fracture forms without dislocation, where *a priori* a fully satisfactory ultimate result might otherwise be expected. It is therefore of importance to form a clear picture of those factors which have a decisive influence on the future course, so that the patient is not given false hopes. These factors are

- 1 The patient's age
- 2 The nature of the injury
- 3 The treatment

1 As in most other fractures, the prognosis in these cases is better for the young than for the old. The fixation of the joint, which is often necessary, seldom causes in the young that stubbornly persisting stiffness which characterizes the aged. On account of reconstruction of bone there frequently occurs in the young a compensatory correction of a deformity that may have arisen. The tendency to posttraumatic arthritis is also greater the older the subject is.

2 The simple cracks as well as the fractures unassociated with dislocation have, naturally enough, a considerably better prognosis than the comminuted or much dislocated varieties. Fractures close to the radial notch in the ulna, however, are more unfavourable than those at other points of the circumference. While the orbicular ligament is more resistant to friction from an uneven surface, the cartilage in the radial notch is very sensitive to such, and arthritic changes are liable to arise there. If abundant callus is formed, the head may even become deformed and be fixed to the ligament or ulna with reduced or abolished rotation as a consequence.

When the capitulum is completely detached, it may sometimes undergo aseptic necrosis with considerably reduced function.

(MADLENER and WIENERT) As periosteum is missing far up on the neck, such fractures have a better prognosis the more distally they are located. In extra-articular fractures the risk of a radio-ulnar synostosis is greater, however (BAUMANN). A fracture in the vicinity of the epiphyseal line in children brings on an earlier ossification of the cartilage with arrested growth. Although this does not influence the function, there often arises an increased valgus of the joint (BERGENFELDT).

The ultimate result will also be worse if a complicating injury of the bone is present at the same time, e. g. a fracture of the olecranon, or if there has been a luxation of the forearm, which is often attended by shrinkage of the capsule (EHLERT). In such cases treatment is chiefly directed to the complicating injury, and care of the radial fracture takes a secondary place. Severe arthritis is not uncommon in such cases. In contusion of the elbow muscles the site of injury may sometimes become the seat of myositis ossificans. The result is also unfavourable if a nerve injury has arisen, as in a lesion of the deep branch of the radialis.

3 The larger case collections show the importance of as early a treatment as possible of the injury. Inveterate cases are found to be very resistant to almost every attempt at therapy. An established synostosis can, practically speaking, never be definitely abolished, the same applying to a fully developed arthritis deformans (VOGLER, HERTER). It is also of the greatest importance for each case to be given just the treatment appropriate to that special case, so that precious time is not wasted with well-meaning but vain attempts to achieve what experience has shown to be impossible to attain.

### Treatment.

This is directed to restoring the natural state of the elbow-joint as completely as possible, and the prerequisite is, of course, that normal anatomical relations are re-established as far as possible. Various authors consider, each according to his experience, that this is best effected by conservative, conservative-operative, or solely operative methods. While mere immobilization has the advantage that the pain is immediately relieved, in certain cases it involves the risk that healing takes place with a fragment or fragments in an unfavourable position. An open operation, on the other hand, ensures visible control and enables the surgeon to attain as ideal conditions as are possible, against which, of

couse, the opening of the joint is attended by a certain risk of infection as well as a risk of injury to the nerves or capsules. Whichever standpoint is taken, however, all are agreed as to the importance of beginning movement treatment as soon as possible.

For the sake of clarity each type of fracture will be discussed separately.

*Cracks* These simple injuries require no special treatment other than for the pains. Cotton-wool dressing round the elbow-joint with the arm in a sling for a few days is considered by all authors to be sufficient.

*Fractures with a slight or minimum dislocation* Also in these cases there is unanimous agreement that a conservative procedure is the correct one. A splint with the arm supinated at 90° flexion for 2—3 weeks and movements from the beginning of the second week should suffice in these cases.

*Fractures with a dislocated fragment* An attempt to replace a dislocated fragment by manipulation has no prospect of being successful. What injury, then, may such a fragment cause if left to itself? All authors seem to be agreed that in such cases true joint-mouse never arises. Probably the situation is that in spite of perhaps considerable displacement the fragment nevertheless hangs a little together with the capsule or ligament, but owing to its size it may, of course, curtail the mobility of the joint. In most cases the modelling power of the joint-movements presses aside a small fragment to such a position that its movement-hampering action is reduced to the least possible. SPRENGELL, SIEBNER, MURRAY, SCHWARTZ, YOUNG, STORCK, SPEED, etc. consider, however, that the fragment ought to be removed as soon as a suspicion arises that it is liable to limit movement. HERTEL, KEY, ELIASON, and NORTH think that the boundary ought then to be drawn at a fragment-size corresponding to one-third of the circumference of the head. Excision should likewise be performed if the detached piece of bone is situated close to the radial notch in the ulna. If the fragment corresponds to two-thirds of the circumference, these authors consider that the whole head ought to be resected. Opposed to these are LASSEN, FONTAINE, BAUER, WILSON, etc., who contend that these injuries should be treated conservatively for a time and that an operation ought only to be undertaken if after 5—6 weeks it is found that the fragment constitutes a definite obstruction to mobility.

As to resection of the head, LEWIS, THIBODEAN, SPEED, KRAUSS, SIEBNER and others claim that recourse should not be had to this procedure because the joint statics are then disturbed, with cubitus valgus and radial flexion of the wrist-joint as a consequence. In itself, however, this does not cause any noticeable impairment of movement, possibly a slightly reduced adduction. Nor is the longitudinal supporting capacity influenced after a resection of the capitulum, since its function in this direction is taken over by the membrana interossea (KEY).

*Comminuted fractures* In these cases all authors are agreed that not only should the fragments be removed but that a resection of the head ought also to be undertaken, as otherwise hypertrophic callus and synostosis may occur. Resection is followed by splintage for 6—10 days and after that movements. To counteract a secondary cubitus valgus and radial flexion of the wrist-joint SPEED suggests the use of a vitallium prosthesis of the shape and size of the capitulum, a method he has employed in three cases with a favourable result.

*Separated epiphysis* These cases require immediate active intervention, viz. repositioning, which in the great majority of cases is very easy to effect (SPEED, YOUNG, SCHWARTZ, SIEBNER, KEY, ROOSVALL, and OPPOLZER). Thereupon a splint is applied for 2—3 weeks. If repositioning fails by other means, which may more especially be the case in inveterate injuries, it must be effected by open operation. In children the capitulum should never be removed since synostosis then usually arises (KEY, BOHRER). Even when it has been completely broken off the head never undergoes necrosis if it is replaced (OPPOLZER).

OPPOLZER describes the technique for manipulative replacement as follows:

*Ethyl chloride anaesthesia* The forearm is extended and supinated and the elbow placed over the operator's thigh, with the inner side downward and under mild pressure so that a varus position arises. Pressure is exerted with the thumb on the capitulum, the arm being gently pronated and flexed. In order not to risk the nerve being injured the pressure is exercised with the thumb from the outer side and not from the inner.

*Metaphyseal chisel-fractures* The five cases described by PHILIPS and GALLAND were fixed for one week with splints, after which kinesitherapy was instituted. All cases were free from trouble in one month.

*Transverse fractures* These are usually impacted in tolerably

good position and are treated with fixation for 2—3 weeks, movements being commenced from and including the third week. When a dislocation is present reduction must be undertaken, if necessary by open operation.

*Neck fractures.* Non-dislocated varieties are treated conservatively with a splint for 3—4 weeks. When dislocation is present, a repositioning must be performed to enable the circumference of the head to rotate in the notch. In adults this is seldom successful without recourse to the knife. Even in gross dislocation the periosteal attachment is intact as a rule, to a higher degree the further distally the fracture is located (BAUMANN). If replacement by open operation is unsuccessful there remains only resection of the bony splinter. Risk of synostosis is always present in cases where the fracture is located extra-articularly.

In children the procedure is different as regards the dislocated varieties. Thus, conservative treatment with extension by mastisol adhesive strapping for 1—2 weeks is recommended if the angle between the fragments is less than  $45^\circ$ , it having been found that the power of rotation in these cases is good (SIRBNER ED. BLERG ROOSVALI). If the angle is more than  $45^\circ$ , it is considered by OPPOLZER that correction should be undertaken, if necessary by open operation, after which extension with mastisol adhesive strapping for 2—4 weeks. Resection must never be performed on children as the risk of synostosis is great in such cases and a troublesome valgus often arises (SPRINGELL, ROOSVALI).

*Combination fractures.* Treatment is directed primarily to the accompanying injury, for instance a fracture of the olecranon and only in the second instance is the radial injury dealt with, if this requires special attention at this later stage, e. g. a synostosis or obstructive fragment.

As was pointed out above there is a unanimous opinion as to the importance of early movement treatment. MASON and SHUTKIN recommend heat and movements from the first day without any fixation whatever, and they report 18 cases with favourable result. FONTAINE and KRAUSS recommend novocain injections in the muscles and the peri-articular tissue to combat pains and tendency to contracture. Massage is not recommended, because this treatment is thought to increase the risk of a myositis ossificans arising (BOHLER, PRAB, LASSEN, BURMANN).

Lastly, some words may be added respecting the operative technique in injuries to the upper end of the radius.

The joint may appropriately be opened by a curved incision from the external epicondyle along the brachioradials and extending to just distally of the capitulum radii. The tissues are separated, without cutting, in the longitudinal direction, special care being taken of the branch of the radials, which passes somewhat more inwardly. The capsule is split longitudinally. The orbicular ligament is spared, if possible. On removing fragments great care should be exercised not to leave any small splinters behind, such being liable to give rise to callus formation. This is most easily effected by washing. All aspects of the capitulum should be inspected by means by pronation and supination of the forearm. Any injury to the ligament must be repaired, as otherwise adhesions to the collum may arise, with reduced rotation as a consequence. The repositions are followed by fixation, preferably with metal pins (MOTTI) or silk (MADLENER and WIENER). In resection of the capitulum the periosteum is stripped off a few centimetres distally, the medullary cavity is excoriated, and the stump is covered with fascia plastic to prevent growth of callus.

When should operation be undertaken? Whereas formerly it was considered best to wait several weeks, the opinion now seems to be that operation should preferably be carried out as soon as possible after the trauma, which as a rule will be as soon as the skin permits. The reason for this is that, if there is a delay beyond 6—8 weeks, an arthritis deformans has time to develop and there will be little or no benefit from the operation.

From reports collected from the literature the treatment may be briefly outlined as follows

*Fissures* Arm-sling for a few days

*Fractures with very little or no dislocation* Splint for 2—3 weeks

*Fractures with dislocated fragment*

*a* Involving less than one-third of the circumference and not located close to the ulna splint for 2—3 weeks

*b* Involving more than one-third of the circumference or located close to the ulna excision + splintage for one week

*c* Involving more than two-thirds of the circumference resection of the head + splintage for 6—10 days

*Comminuted fractures* Resection of the head + splint for 6—10 days

*Separation of epiphysis* Reposition ad modum OPPOLZER, in the last resort by open operation, whereupon splintage for 2—3 weeks

*Metaphyseal chisel-fracture.* Splint for one week

*Transverse fractures* Splint for 2—3 weeks. Where dislocation is present, reposition, if necessary by open operation

*Neck fractures*

- Adults,    *a* Non-dislocated splint for 3—4 weeks  
               *b* Dislocated open reduction + splint for 3—4 weeks  
                   Resection if reduction fails
- Children, *a* Non-dislocated splint for 2—3 weeks  
               *b* Dislocated less than 45° angle extension with  
                   mastisol adhesive strapping for 1—2 weeks  
               *c* More than 45° angle replacement, possibly open +  
                   extension with mastisol adhesive strapping for  
                   2—4 weeks

*Combination fractures* Treatment, by current methods, is first directed to the complicating injury. Care of the injury to the radius is secondary.

Movement treatment is instituted early. In cases with rather long fixation of the joint the splint should be removed as soon as possible a couple of times daily and gentle movements performed.

**Personal Material.**

During the years 1931—1944 141 cases of fracture of the upper end of the radius have been treated at the Surgical Department here, this corresponding to 1.78 % of all fractures (= 7,904) and 26.85 % of fractures in the elbow region (= 525). The distribution of the material can be seen from Tables 1 and 2.

As regards the cause no case among those in the age-group up to 10 years was found in which the fracture was due to indirect violence. Otherwise, the *direct — indirect violence* figures are much the same. The relations between type of fracture and type of violence show no considerable differences, except as regards fractures of the neck, where direct violence is strongly predominant. The relation between fracture-type and age shows that fractures of the neck were somewhat more numerous in the group up to 20 years, while fractures of the head were more common between 20—50 years.

Altogether 99 cases have been followed up. Of these, ten had been treated surgically, the others conservatively, as a rule with plaster of Paris splints for 3—12 weeks. They had then been given movement treatment, warm baths and occasionally massage. The massage treatment was broken off four times by the patients themselves, who noticed that it made their condition worse. In many cases the patients themselves pointed out the tangibly good

FRACTURES OF THE HEAD AND NECK OF THE RADIUS

## Trauma

AND NECK OF THE RADIUS

- Fissure
- Non displ
- Disl
- Comminuted
- Transverse frac-  
ture
- Epiphyseolysis
- Metaphysal
- Collum fr
- Comb fr

# WEEK OF THE RADIUS

Fracture form

Conservative

### Operative

Table 4.

Of 141 cases, 99 = 70.2 % followed up	Treatment	Result		
		Restitutio ad integrum	Satis- factory	Bad
Adults = 85 cases	Conservative = 76 cases	62	10	4
	Operative = 9 cases			
	Fragment extirp Resection	1 2	1 2	— —
Children = 14 cases	Conservative = 13 cases	10	2	1
	Operative = 1 case (resection)	1	—	—

effect of the hot-bath treatment of the elbow-joint Table 3 shows the space of time that was required in the different cases before mobility returned to the normal

It is distinctly seen how uncertain the prognosis as regards duration of illness may be even in the case of the more benign varieties of fracture Thus, one case of simple crack required three months, and several cases of chisel-fracture without noticeable dislocation 3—12 months, before full mobility was attained In most of the cases, however, an unnecessarily long immobilization, varying up to 6 weeks, may be interpreted as the cause of this delay

The conservatively treated cases of fracture associated with dislocation show about the same results as those operatively treated It should be pointed out, however, that the cases which underwent operation exhibited considerably greater anatomical disproportions, and hence these would doubtless have presented much inferior results if they had been treated conservatively Of the combination fractures conservatively treated, two were backward luxations, which recovered full mobility after 3 months A case with olecranon fracture in good position regained full mobility in one year In one case with a small splinter from the coronoid process of the ulna and a fragment split off the head of the radius the latter was removed and mobility was fully restored in six weeks An account follows of a case of some interest

Girl, aged 12 Transverse fracture immediately below the capitulum which was completely split off and lay dislocated laterodistally along



Fig 1 a



Fig 1 b



Fig 2 a



Fig 2 b

FELTSFROM Fractures of the Head and Neck of the Radius



Fig 3 a



Fig 3 b

side the shaft of the radius. As at this time our attention had not yet been directed to the value of as conservative a procedure as possible in this variety of fracture, no reposition was carried out but the head was excised. The postoperative course was complicated by a paresis of the radialis, probably caused by pressure of a hook during the operation, but this paresis disappeared entirely after two months. After five months the patient showed full mobility of the joint and stated that she was quite free from pain. It remains to be seen, however, what the future course will be, i. e. whether or not valgus or synostosis will arise.

Table 4 shows the ultimate results of treatment. The cases considered to show a bad result were as follows:

*Case 1* Woman, aged 57 years. Fracture through the collum radii with total detachment of the capitulum but without noticeable dislocation. At the upper edge of the head, towards the front of the joint, there was a small splinter of bone. Treated with plaster of Paris for 9 weeks followed by passive movements. Flexion and extension  $60^{\circ}$ — $150^{\circ}$ . Limitation of pronation  $30^{\circ}$ , of supination  $20^{\circ}$ . On the radiograph a coarse osteophytic growth at the lower girth of the internal condyle as well as some small bodies of bony density immediately below, probably calcifications or ossifications in the capsule itself. Some small bodies at the anterior circumference of the joint. The head of the radius is very moderately deformed by an irregularity in its radial girth, affecting both the circumference and the joint surface (Fig. 1).

*Case 2* Woman, aged 60. A compression fracture of the capitulum radii, which was split up into a number of fragments. These were somewhat dislocated, some in a distal direction. Plaster of Paris for 6 weeks, then passive movements. Full flexion but limitation of extension  $25^{\circ}$ , of pronation  $10^{\circ}$  and of supination  $30^{\circ}$ . The radiograph is unaltered on the whole. No marked deformations. An important point in judging this case is the fact that the patient did not present herself for treatment until one month after the time of the accident (Fig. 2).

*Case 3* Woman, aged 56. Luxatio cubiti post. with splintering of the capitulum radii, the anterior portion of which lay dislocated to the front of the joint. Its posterior portion was left behind in approximately its proper position but was split into a couple of fragments. After reposition and plaster fixation the luxation was abolished. The part split off the head still lay forward in the joint, while the other parts occupied their right position or thereabouts. Operation was recommended but refused. Plaster of Paris for 6 weeks, thereupon movements. Now full flexion but an extension defect of  $35^{\circ}$ . Supination range  $10^{\circ}$  but entire loss of pronation. Control examination shows deformation of the head of the radius — with defective anterior circumference, the old fracture surface being here rounded and slightly sclerosed. The outward portion of the head is gross, obviously as a result of a vigorous

bony healing of the detached fragment. Otherwise the joint largely presents the same appearance as on the previous occasion — there are thus hardly any sure signs of an increased deforming process (Fig 3)

*Case 4* Man, aged 45. Compression fracture of collum radii with slight depression of the capitulum. Plaster for 4 weeks, then movements.  $20^{\circ}$  limitation of both flexion and extension. Full pronation but much curtailed and painful supination. Control examination shows the fracture to be well healed, with a slight depression of the head so that there is a greater difference in level here between the capitular and ulnar joint-surfaces than on the unaffected side.

*Case 5* Boy, aged 9. Separation of the epiphysis of the capitulum radii with depression and outward displacement of the epiphyseal fragment. Plaster for 4 weeks, then movements. Extension and flexion limitation of  $30^{\circ}$  as well as pronation and supination defects of  $35^{\circ}$ . The head is firmly healed in its original position with the joint-surface facing outwardly and forward.

### Discussion.

What is there to be learnt from these five cases? In the light of our present knowledge of these fractures it may be said that the treatment ought possibly to have been different with perhaps a more favourable issue as a result.

Respecting the *first case*, this was certainly immobilized too long. Half the time would no doubt have sufficed. Possibly the dislocated fragment ought to have been excised, perhaps the whole of the split off head should have been resected. In the last-mentioned case fixation might very well have been cut down to a week or two.

In the *second case* the splintered capitulum ought to have been resected. It is however uncertain whether the result would have been different, as a month had elapsed since the time of the accident.

In *case 3*, operation was recommended but refused. With operation the immobilization could have been shortened from the 6 weeks it lasted to a week or two, probably with a less impaired mobility.

In *case 4* it may be objected that an attempt at reposition ought to have been made. The patient's present troubles illustrate the importance of obtaining as ideal conditions as possible in the proximal radio-ulnar articulation.

The *fifth case*, finally, clearly shows the importance in the case of children of a reposition being undertaken with restoration of the natural anatomical relations. Left unreduced, these dislocated separated epiphyses, as in the cases now mentioned, give very bad functional result.

### Summary.

After a short survey of various types of fracture of the upper end of the radius, their etiology, symptoms, and prognosis an account is given of the different methods of treatment that have been found described in the literature

Out of a material comprising 141 cases, 99 have been personally followed up Of these, 89 had been treated conservatively and 10 had been submitted to operation The result in five cases, all belonging to the former group, was judged as bad, otherwise it was good On the basis of what has emerged from a study of this material and a perusal of the literature the following directives may be drawn up respecting the treatment

- 1 Non-dislocated fractures should be treated conservatively
- 2 Large, dislocated fragments should be excised
- 3 In comminuted fractures the head should be resected
- 4 Dislocated fractures of the collum should be reduced, if necessary by open operation If this fails, resection should be performed
- 5 In the case of children careful reposition, which as a rule is easily effected, is of great importance Otherwise considerable limitation of function may arise Resection should never be undertaken
- 6 So short an immobilization as possible with early institution of kinesi- and thermo-therapy Massage is not indicated

### Zusammenfassung.

Nach einem kurzen Überblick über verschiedene Formen von Fraktur der oberen Speichenpartie, ihre Ätiologie, Erscheinungen und Prognose, werden die einzelnen Behandlungsmethoden angegeben, die der Autor in der Literatur gefunden hat Der Verf hat von einem aus 141 Fällen bestehenden Material 99 nachuntersucht, von diesen waren 89 konservativ und die restlichen 10 operativ behandelt worden In fünf Fällen, alle konservativ behandelt, ist das Ergebnis als schlecht zu bewerten, in den übrigen als gut Nach den Erfahrungen aus diesem Material und dem Studium des einschlägigen Schrifttums lassen sich betreffs der Behandlung folgende Richtlinien aufstellen

- 1 Nicht dislozierte Frakturen werden konservativ behandelt
  - 2 Grossere, dislozierte Knochensplitter werden extirpiert
  - 3 Bei komminuten Frakturen wird das Capitulum reseziert
  - 4 Dislozierte Collumbrüche werden reponiert, evtl blutig
- Bei Misslingen Resektion
- 5 Bei Kindern ist sorgfältige Reposition, die in der Regel auch leicht durchzuführen ist, von grosser Wichtigkeit. Sonst kommt es zu erheblichen Funktionseinbüssen. Niemals Resektion!
  - 6 Möglichst kurze Ruhigstellung, frühzeitig einsetzende Bewegungs- und thermische Behandlung. Massage nicht angebracht

### Résumé.

Un aperçu des différentes sortes de fractures de l'extrémité supérieure du radius, de leurs causes, symptômes et développements, est suivi d'un rappel des différentes méthodes de traitement dont il est rendu compte dans la littérature médicale.

Parmi 141 fractures traitées, l'auteur a procédé à un examen postérieur de 99 d'entre elles, dont 89 avaient été traitées sans intervention chirurgicale et 10 opérativement. Pour cinq d'entre elles, toutes du premier groupe, le résultat pouvait être jugé mauvais et bon pour les autres. Il résulte de l'étude des différents cas examinés et de l'examen de la littérature médicale que les directives suivantes peuvent être données concernant les méthodes de traitement à adopter.

- 1 Les fractures non disloquées seront traitées sans intervention chirurgicale.
- 2 Les gros fragments disloqués seront extirpés.
- 3 Pour les fractures comminutives, résection du capitulum.
- 4 Les fractures disloquées du col seront réduites, éventuellement en opérant. En cas d'insuccès, pratiquer la résection.
- 5 Pour les enfants, il est très important que la réduction soit pratiquée méticuleusement, ce qui est facile en général, sinon, d'importantes déficiences fonctionnelles se produisent. La résection ne doit jamais être pratiquée.
- 6 L'immobilisation sera aussi courte que possible, le traitement par la chaleur et les mouvements sera commencé tôt. Le massage n'est pas indiqué.

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## Deeply Situated Multiple Glomus Tumors.

### Case Report.

By

RAGNAR FRYKHOLM

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The peculiar and characteristic symptomatology presented by glomus tumors seems to have been described for the first time in modern medical literature by WOOD in 1812 under the designation of "painful subcutaneous tubercle" WOOD states that similar conditions were observed already by Hippocrates and Galenus (quoted from GRIEG) STOUT mentions several surgeons and anatomists of the eighteenth century, who were familiar with these lesions

BARRÉ (1920) is generally credited to have been the first to prove that the pain in these cases could be abolished by removal of the tumor WOOD, however, had earlier treated a superficial glomus tumor with cautery and attained relief through this measure LABBÉ and LEGROS (1870) report three cases relieved from pain by operative removal of small subcutaneous nodules, causing symptoms, which we now can say were absolutely characteristic for glomus tumors Their specimens were, however, not histologically examined

The histology of these lesions was first studied by MASSON in 1924, who also was the first to emphasize their striking morphological resemblance with the arteriovenous anastomoses which normally are to be encountered in certain parts of the skin These anastomoses were already then fairly well known through investigations by BERRES, J MULLER, SUQUET and HOYER, but the assumed intimate relationship between glomus tumors and arterio-venous anastomoses greatly stimulated to further investigations of the histology and physiology of the latter (HAVLICEK, GRANT, BLAND, LEWIS et al)

Simultaneously a great many cases of glomus tumors in various locations were put on record CLARA (1939) in an extensive study collected 166 cases from the literature The first two cases in Sweden were reported by BERGSTRAND in 1937

According to the definition of glomus tumors, given by CLARA, these lesions are generally solitary and always referred to the skin CLARA even maintains that previously reported cases with multiple glomus tumors (among which even BERGSTRAND's cases are mentioned) hardly stand for a more serious critique (Page 141), but no argumentation is presented for this point of view It seems, however, hard to understand why glomus tumors necessarily should be solitary if they really are so intimately related to arterio-venous anastomoses, of which there are thousands in each individual It also seems difficult to explain why glomus tumors should develop only superficially, as arterio-venous anastomoses, quite similar to those in the skin, actually have been demonstrated also in deeper structures of the body

The arterio-venous anastomoses are mostly concentrated to the distal parts of the extremities where they lie so close together that they easily can be studied in a histological preparation In other parts of the body, including the deep structures, their occurrence is more sparse and they are therefore difficult to demonstrate Our knowledge with regard to the occurrence of arterio-venous anastomoses in various structures of the body is indeed still defective Under such conditions every case of glomus tumor of unusual situation is of great interest in order to supplement our knowledge with regard to the normal distribution of arterio-venous anastomoses in the human body

### Case Report.

O O, a factory-hand, aged 39 (born 1905), already at the age of 8 to 9 began to experience paroxysmal pains in the right ankle and around the achilles tendon Their onset as well as disappearance was quite sudden and they usually continued for periods ranging from one to twenty-four hours, the pain-free intervals being from some days to a week The pain would usually disappear if he lay down and held the foot elevated During the attacks a slight swelling was sometimes observed about the ankle

In 1923 he was hospitalized for the first time and treated with massage but with no effect on his pains On returning to his employment he was given work which he was able to perform in a sedentary position, which affected some diminution of the pain

In 1927 he was kept in bed in a plaster-cast for 9½ weeks because of a suspected pelvic fracture. During all this time he was completely free from pain in his foot, but as soon as he got out of bed, the pain returned worse than ever before. A *periarterial sympathectomia* did not improve the condition and then a resection of some posterior nerve-roots was performed. This rendered the foot partly anaesthetic and effected some improvement of the pain.

By 1931, however, the condition gradually deteriorated with severe pain every day, referred to the same area as previously.

In april 1935 he was for the first time admitted to the Neurosurgical Clinic of the Serafimer Hospital. The examination revealed marked muscular atrophy of the right leg with diminished power in the ankle. The superficial sensibility was also diminished in the whole leg, but most pronounced distal to the knee as an effect of the rhizotomy. Near the lateral malleolus some subcutaneous nodules could be palpated, in size slightly larger than a pea. They were all exceedingly tender to pressure in spite of the diminished superficial sensibility of the region.

*Operation* was performed by Dr O SJOQVIST. Three small well encapsulated tumors were extirpated, one of which was found sub-fascially and another in relation to the sheath of the peroneus tendon.

For two months postoperatively the patient was relatively free from pains, but then they returned. They now came from one small tumor near the lateral malleolus and another focus of tenderness just in front of the achilles tendon. If this tendon was pressed from behind or pressure exerted to the grooves on both sides of it, violent attacks of pain were started. The whole foot was very sensitive to heat and even minimal traumas. About one year after the first operation the patient returned and was reoperated by Dr SJOQVIST. Even this time three tumors were extirpated, two of which were deeply situated, one in the adipose tissue of sinus tarsi and the other close to the peroneal nerve.

The microscopical examination was performed by Professor H BERGSTRAND, who established the diagnosis of glomus tumor and gave a report of the case history up to that date (*Amer J of Cancer* 1937 29 470 and *Nord med tidskr* 1937 13 361).

*Postoperative course* Immediately after the second operation the patient felt much better, but was never completely relieved of his pains. He soon noticed another subcutaneous nodule near the medial malleolus and observed that the tenderness in front of the achilles tendon only had been slightly affected through the operation. The pain at this spot grew worse every year and gradually made it impossible for him to wear boots. His foot became more and more sensible to mechanical influences. Violent attacks of pain were elicited even by the slightest vibrations such, for instance, that occur in the feet on walking over gloggy snow or the vibrations of a floor upon which other people were moving about. Finally his condition became so unbearable that he seriously discussed the possibility of having his leg amputated.

In april 1944 he was readmitted to this neurosurgical clinic. Examination of the right foot and leg showed no abnormalities in general.

appearance, skin temperature or sweating. A slight swelling above the lateral malleolus was, however, observed. The four scars after previous operations were well healed and not tender to pressure. A few centimetres distal to the medial malleolus a subcutaneous nodule was palpated. Its size was about that of a grain of rice and it was tremendously tender to pressure. At a level of about 10 cm. above the ankle joint the same kind of pain could be elicited by exerting pressure either to the dorsal surface of the achilles tendon or to the grooves on both sides and in front of it.

*Operation (Frykholm)* under local anaesthesia. The subcutaneous nodule near the medial malleolus was distinctly localized through palpation with the point of a probe. After incision of the skin, it was easily identified and extirpated. It had a grayish-white color and was rather firm and elastic in consistence. There were no grossly visible connections to either nerves or vessels in the vicinity.

Around the upper limit of the achilles tendon there was also a very marked tenderness to pressure. Here, however, it was impossible to localize any distinct pressure-point. It was evident that there must exist either several small subcutaneous tumors or one single large tumor, which could be influenced by pressure to the achilles tendon as well as to the tissue to both sides of it. It was also clear that it would be extremely difficult to find the causative lesion if this characteristic pressure pain was obtused by the anaesthetic. Therefore, to begin with, only the skin was infiltrated. Two incisions were then made on both sides of the achilles tendon. In the skin and subcutis nothing abnormal was observed. Then some more tissue was infiltrated and the dissection continued in both wounds alternately and gradually carried down between muscles and tendons towards a point from which all the time a furious pressure-pain could be elicited. *The lesion was found to be a single well encapsulated tumor, quite the size of a hazelnut, situated in the fascial space between the interosseous membrane and the muscles of the calf, about 10 cm. proximal to the ankle joint.* It had a bluish color and was easily compressible, but bulged out to its original size as soon as pressure was released. At a first glance it was taken for a varicosity of a vein but scrutiny revealed that it was built up of several tortuous thin-walled vessels, between which a grayish substance could be seen, having the same appearance as the previously extirpated tumor. The lesion did not seem to pulsate, but when punctured with a needle, the blood discharged through the opening was observed to have a brighter red color than that of usual venous blood indicating a rich arterial supply. The whole lesion was extremely tender to pressure in very marked contrast to the insensitiveness of the surrounding tissue. After thorough infiltration with etocain the tumor was isolated and when four small vessels had been severed between silver clips it could be removed. No nerves were seen, entering the tumor. The wound was closed with interrupted sutures of fine silk.

The patient was dismissed on the tenth postoperative day and was completely relieved from his previous symptoms. He began to work one week later and ten months postoperatively reported that he was

doing quite well and that the pains had never returned. He was now able to perform his work standing all day, he was even able to wear boots and go for long walks without suffering any inconveniences.

*Biopsy* The specimens were microscopically examined by Dr RINGERTZ at the Pathological Department of the Serafimer Hospital who made the following statement:

The small nodule is a glomus tumor, the cellular tissue of which is enclosed in a fibrous capsule, containing thin-walled blood-vessels of a mostly irregular type.

The larger specimen is also a glomus tumor of principally the same composition. Its compact layers of glomus cells are enclosed by a membrane of partly loose, partly dense connective tissue, which contains a great number of large blood-sinuses. Their walls consist of a layer of thick endothelial cells and a few muscle-fibres. In some places glomus-tissue seems to be developing through proliferation of these cells. The membrane also contains larger arteries and veins and some atypical vessels, indicating the presence of an arterio-venous anastomosis. In Davenport-preparations several groups of myelinated nerve fibres can be seen penetrating the membrane and following the larger blood-sinuses.

### Discussion.

The following authors have previously reported cases with multiple superficial glomus tumors:

1	WOOD (1812)	3	tumors in the gluteal region
2	GRIEG (1928)	3	» » » deltoid »
3	ADAIR (1934)	4	» on the forearm
4	STOUT (1935)	2	» on the heel
5	HVAL, MLLSON (1936)	9	» on the right arm and hand
6	TOURNAIE et AL (1936)	24	» on trunk and extremities
7	» » » »	7—8	» on the arms
8	WEIDMANN, WISE (1937)	48	»
9	PLEWES (1941)	4	» in a fingertip

Only three cases with deeply situated glomus tumors were reported:

1 ANDRÉ-THOMAS (1933) Male, aged 27, who 1½ year after a contusion of the inside of the left leg began to suffer from paroxysmal pain referred to two small nodules. One of them was situated upon the external muscular fascia and the other deep within the muscles of the thigh. After their removal the patient was completely relieved from pain. Microscopic examination revealed large cavities, lined by multiple layers of epitheloid cells and filled with blood.

2 BERGSTRAND (1937) Case 1 is the earlier history of the case here presented.

3 BERGSTRAND (1939) Case 2 Man, aged 21, who developed pains in the left foot after a trauma one year previously Roentgen-examination revealed areas of rarefactions in the talus, calcaneus, cuboidum and proximal part of metatars V, simulating osteitis fibrosa At operation one tumor was found between the vessels and nerves behind the medial malleolus, and somewhat deeper, partly within a cavity in the head of the talus, another tumor of the same appearance Histologically they corresponded to the tumors of the previous case

The common feature for all those lesions which in the literature are presented as glomus tumors is the microscopical appearance of large blood-sinuses, directly bordered by compact layers of epitheloid cells The tumors are supplied with blood through atypical arteries and veins, and they often contain nerve-fibres

From the clinical point of view nearly all tumors have presented a very characteristic type of paroxysmal pain. In the case of WEIDMANN and WISE, however, pains were absent and the tumors were not even tender to pressure Microscopic examination failed to demonstrate any nerve-fibres, though the appearance otherwise exactly corresponded to that of glomus tumors. It might be questioned whether such a case should be classified as a real glomus tumor or referred to a special morbid condition ADAIR, however, reports a case with three tumors of which two were insensitive, but the third one gave rise to pain This case speaks in favour of the assumption that pain need not always be present in glomus tumors

In the case here presented, however, every single tumor gave rise to a very distressing pain, and their microscopical appearance was quite characteristic They all contained abnormal blood-vessels, leading into vascular channels, lined by massive layers of glomus cells Nerve-fibres were also demonstrated

There was, however, a marked difference between the last extirpated tumor and the seven previously extirpated ones These were all relatively small, their size not exceeding that of a small pea Grossly they seemed to be built up of a compact substance of grayish-white color They were all found in the malleolar region, three of them superficially and the rest somewhat deeper

The eighth and last extirpated tumor certainly had a site a little away from the region to which the rest were concentrated, but being situated not more than 10 cm from the others it may well be regarded as belonging to the same group of lesions It

was, however, considerably larger than all the others and appeared, even to the naked eye as a vascular anomaly. Tumors of this type, highly vascular, with a bluish color have previously been observed superficially in the skin, while the deep situation of the tumor in our case is remarkable and indicates that normally arterio-venous anastomoses probably are present in this region.

An interesting question is whether all the eight tumors in our case have developed simultaneously or successively. The fact that the patient never was completely free from pain until the last large tumor in the lower leg was identified and extirpated speaks in favour of a simultaneous development.

In the case of ANDRÉ-THOMAS an intramuscular glomus tumor developed as a result of a trauma. Whether this was due to a preexisting normal glomus in the contused area or to the formation of a traumatic arterio-venous anastomosis which later on was transformed into a glomus tumor, is impossible to say.

In our case it has not been possible to demonstrate any traumatic eliciting factor. On the contrary there is some evidence indicating a congenital malformation. It may well be assumed that under some stage of early embryological life there must have existed some non-differentiated tissue, which later was going to be transformed into a number of arterio-venous anastomoses destined for the region in question. Some local disturbance to this tissue may have resulted in the formation of glomus-tumors instead of normal arterio-venous anastomoses or, perhaps, in the development, of a special kind of glomus, which under the influence of some additional endogene or exogene factor during the patient's childhood were transformed into real glomus tumors.

### Summary.

Glomus tumors are usually solitary and situated superficially. A few cases with multiple, superficial glomus tumors and only three cases with deeply situated lesions have previously been reported. One of BERGSTRANDS' cases was recently reoperated by the author. An extraordinarily large glomus tumor, the size of a hazel-nut, situated 10 cm proximal to the ankle joint in the fascial space between the interosseous membrane and the muscles of the calf, was identified and removed. This unique location suggests that normally arterio-venous anastomoses may be found in

this region The multiplicity of lesions in this case, within a limited area about the ankle joint, and the absence of any exogenous eliciting factor, indicates — with regards to the pathogenesis — a developmental defect in early embryological life

### Zusammenfassung.

Glomustumoren sind gewöhnlich solitar und oberflächlich gelegen Eine geringe Anzahl von Fällen mit multiplen, oberflächlich gelegenen Glomustumoren und drei Fälle von in der Tiefe gelegenen Tumoren sind früher beschrieben worden Einer der Fälle von BERGSTRAND wurde neuerlich von dem Verfasser reoperiert Ein Glomustumor von ungewöhnlicher Grösse (haselnussgross) lokalisiert 10 cm proximal von dem Fussgelenk im Spatium zwischen Membrana interossea antecurvis und der Unterschenkelmuskulatur wurde gefunden und exstirpiert Diese ungewöhnliche Lokalisation stützt die Annahme, dass normale arterio-venöse Anastomosen in dieser Gegend zu finden sind Die Tatsache, dass in diesem Fall eine Mehrzahl von Tumoren in einem begrenzten Gebiet in der Nähe des Fussgelenks gefunden worden sind, welche sich ohne exogene auslösende Faktoren entwickelt haben, spricht — mit Hinsicht auf der Pathogenese — für eine lokalisierte Störung in der frühen embryonalen Entwicklung

### Résumé.

Les tumeurs glomiques sont habituellement solitaires et superficielles Un petit nombre de cas des tumeurs multiples superficielles et seulement trois cas de tumeurs avec une localisation profonde ont été décrits auparavant Un des cas de BERGSTRAND a été récemment réopéré par l'auteur Une tumeur glomique d'une dimension extraordinaire (du volume d'une noisette), située 10 cm proximal de la tarse dans l'espace fascial entre la membrane interosseuse et la musculature du mollet fut identifiée et exstirpée Cette localisation unique d'une tumeur glomique indique que des anastomoses arterio-veineuses normales existent probablement dans ce tissu La multiplicité des lésions dans ces cas dans une zone limitée autour de la tarse et l'absence d'aucun facteur étiologique exogène, indique — au point de vue de la pathogénèse — un trouble localisé dans le développement embryonale précoce

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## Duodéno-gastrectomie dans les Cas compliqués d'Ulcère pénétrant et de Tumeurs péri-ulcéreuses.

Par

ERIK BRATTSTROM

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Tout chirurgien rencontre une fois ou l'autre, dans la région pylorique ou dans la partie supérieure du duodénum, des tumeurs devant lesquelles il hésite peut-on ou ne peut-on pas pratiquer une résection? Il s'agit généralement d'un ulcère calleux pénétrant dans le pancréas, avec infiltration couenneuse et œdème des tissus environnants, s'étendant principalement en haut vers le ligament hépato-duodéal et comprenant les voies biliaires dans son tissu fibreux. L'enchevêtrement des éléments anatomiques peut être si anormal que l'on n'ose tout simplement pas pratiquer une résection par crainte de léser les voies biliaires. Les obstacles déterminent souvent l'opérateur à renoncer à une opération radicale et à se contenter d'une intervention plus simple, telle que la gastro-entérostomie ou une «Resektion zur Ausschaltung», qui souvent ne procure pas au malade l'amélioration escomptée pour ne pas parler des pénibles complications qui peuvent se produire.

De fait, on rencontre parfois des tumeurs péri-ulcéreuses devant lesquelles la technique abdique. Mais il y a certains cas où la résection est possible au moyen d'une technique que j'ai employée de temps à autre depuis plusieurs années. Peut-être d'autres chirurgiens ont-ils utilisé le même procédé, bien que je n'aie trouvé aucune communication à son sujet. C'est pourquoi le praticien et l'étudiant apprécieront probablement l'aide que leur fournira une description de ce procédé, d'autant plus que je ne l'ai trouvé mentionné dans aucun traité de technique opératoire.

Dans les cas mentionnés plus haut, j'ai procédé de la façon suivante

Après avoir ouvert l'abdomen par l'habituelle incision médiane épigastrique et s'être orienté sur l'étendue de la tumeur et les possibilités de la résection, on lie les vaisseaux que l'on peut atteindre sur une petite portion de la grande et de la petite courbure de l'estomac, au-dessus de la tumeur, de telle façon qu'une pince stomacale introduite en cet endroit empêche le contenu de l'estomac de s'écouler lors des manipulations qui suivront. Là-dessus, on entoure le duodénum d'un matelas formé d'une ou deux compresses abdominales posées latéralement et en bas vers le foie et la loge rénale droite. Ceci une fois fait, l'opérateur introduit son index gauche dans le trou de Winslow derrière le ligament hépato-duodénal. Puis il prépare le canal cholédoque après l'avoir ponctionné pour s'assurer de sa position, il pratique une petite incision dans sa paroi antérieure, éventuellement entre deux points de suture de fixation. Par cette incision, on introduit un fin cathéter (sonde) de gomme demi-molle que l'on fait pénétrer jusque dans le duodénum. Il ne doit naturellement pas être si fin et mou qu'il échappe à la palpation qu'on éprouvera souvent le besoin de pratiquer au cours de l'opération. Un écoulement éventuel de bile sera reçu sur les compresses introduites au début ou absorbée par succion (Fig. I).

On passe ensuite à la résection elle-même.

On sectionne la paroi antérieure du duodénum, à l'endroit convenable, *au-dessous* de la tumeur. Ce faisant, on découvre, sur la paroi postérieure du duodénum, l'ulcère qui a éventuellement pénétré dans le pancréas et l'on peut observer nettement son bord inférieur. *Au-dessous* de ce bord *inférieur* de l'ulcère, on sectionne alors la paroi duodénale postérieure à l'endroit convenable et l'on pénètre ensuite prudemment à travers les diverses couches (Fig. II).

Guidée par l'index gauche introduit dans le trou de Winslow, soulevant par derrière la sonde introduite dans le canal cholédoque, la palpation oriente facilement sur la position de celui-ci, on peut alors avec beaucoup plus de facilité et de sécurité séparer la paroi duodénale postérieure du tissu environnant et des canaux biliaires sans léser ces derniers. Du reste quand on en est arrivé là, on est souvent surpris de la facilité avec laquelle on peut libérer la paroi duodénale postérieure du tissu environnant. On réussit parfois à le faire simplement en introduisant

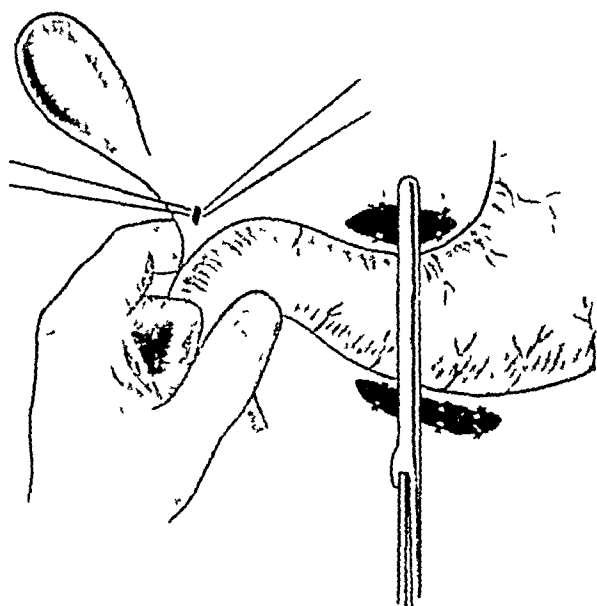


Fig I

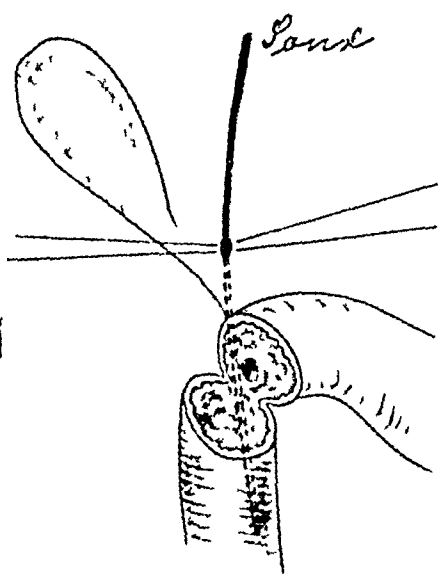


Fig II

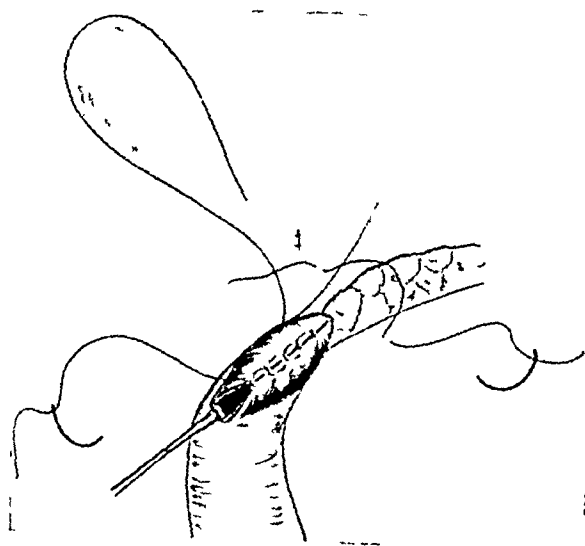


Fig III

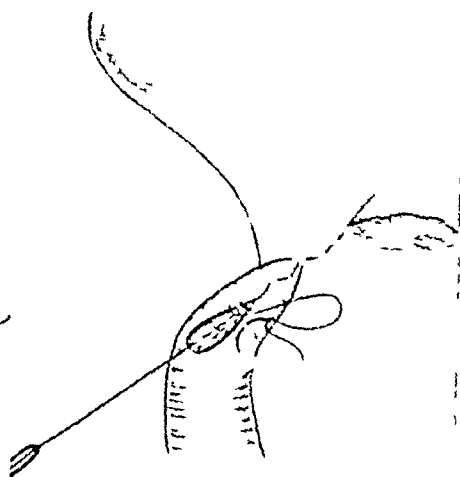


Fig IV

par en haut la pointe de ciseaux mousses entre la dite paroi et le tissu pancréatique adhérent et en ouvrant ensuite prudemment les branches On lie les vaisseaux des bords du moignon duodénal dans la mesure nécessaire, après quoi il est facile de le fermer et de l'invaginer suivant le procédé courant par un triple rang de sutures On peut *parfois* se faciliter la tâche en saisissant la paroi antérieure du duodenum en son milieu au moyen d'une suture de fixation ou une pince fine et à exercer sur elle une traction latérale, après quoi on suture la muqueuse en commençant par la partie interne pour se diriger ensuite vers le point de fixation sur la paroi duodénale antérieure Puis on péritonise la paroi postérieure en suturant par ses bords la séreuse par-dessus la paroi postérieure découverte On ensevelit celle-ci encore plus profondément au moyen d'un rang de sutures qui rapproche, cette fois, des surfaces recouvertes de séreuse Cette méthode d'invagination a été décrite antérieurement par un chirurgien finlandais, le professeur ALI KROGIUS, d'Helsingfors, dans le *Zentralblatt für Chirurgie* No 39/1907, p 1138 (Figs III et IV)

Il s'agit ensuite de détacher l'ulcère encore adhérent ainsi que le bulbe duodénal La méthode *ouverte* présentée ici offre un avantage celui d'une dissection aisée de la tumeur en partant du bord *inférieur* de l'ulcère par le contrôle répété au moyen de la palpation de la sonde contenue dans le cholédoque Il est ainsi plus facile d'éviter de découvrir et de devoir lier des fragments de pancréas Des lésions assez importantes du pancréas causent trop souvent, dans les cas d'ulcères dont l'ablation est difficile, une pancréatite complication qui annihile souvent les résultats d'une opération techniquement parfaite à tous autres points de vue De cette façon, on dispose aussi de tissu plus compact pour les sutures, si l'on désire fixer et ensevelir le lambeau duodénal invaginé On évite aussi plus facilement les canaux pancréatiques, car on peut enlever la tumeur en restant assez à la surface Après avoir libéré la partie supérieure du bulbe duodénal avec l'ulcère et sa tumeur, on continue la résection suivant le procédé habituel (méthode BILLROTH II—POLY1) On retire la sonde du cholédoque, puis on suture l'incision faite pour l'introduire, on péritonise on introduit un drain à fenêtres dans la direction du trou de Winslow et on l'amène à l'extérieur par une petite incision spéciale de la paroi abdominale au-dessous du rebord costal droit

Chez certains malades, le champ opératoire est souvent situé profondément et difficile à atteindre. Dans ces cas, on peut se faciliter la tâche en amenant le malade en position proclive au moyen d'un coussin de caoutchouc gonflé qu'on place sous le dos du malade avant l'opération, au cas où la table d'opération manque du dispositif nécessaire.

Ci-après suivent les résumés de quelques cas opérés récemment

(KJ 306 0/44) G K M, machiniste, 50 ans

Traité en 1942 à la section médicale de l'hôpital pour ulcère du duodénum avec *melæna* et anémie consécutive (journ. méd. 475/42). La radiographie montrait, avant et après le traitement suivi, un bulbe déformé et une niche dans le pancréas. Entré à la division de chirurgie le 17/10 1944 sur sa demande d'être opéré. Aux troubles habituels se sont joints des vomissements surtout au cours des dernières semaines. Nouvelle radiographie le 11/10 1944, elle montre encore le bulbe déformé et une niche de la grosseur d'une noisette dans le pancréas.

Le 18/10, duodéno-gastrectomie et gastro-anastomose suivant FINSTERER—POLYA—MAYO, avec cholédochotomie, sondage du cholédoque et drainage (l'auteur). Rachianesthésie avec solution diluée de percaïne. Incision médiane dans l'épigastre. Ulcère avec tumeur de la grosseur d'un pruneau dans le bulbe du duodénum avec profonde niche dans le pancréas, pouvant contenir l'extrémité de l'auriculaire. Oedème environnant. La résection paraît possible bien que les canaux biliaires soient pris dans l'œdème et la tumeur fibreuse qui s'étend vers le haut du ligament hépato-duodénal. Comme il paraît difficile de ne pas léser les canaux biliaires, on prépare le canal cholédoque, on l'incise et y introduit un catéter en gomme demi-molle jusque dans le duodénum, il permettra une orientation sur le parcours des voies biliaires durant toute l'opération. Section du duodénum *au-dessous* de la tumeur. Puis, suivant le procédé habituel, on procède à la résection d'un fragment de 380 cm<sup>2</sup> qui porte l'ulcère pénétrant et calleux du duodénum. On met le drain en place, l'extrémité interne en haut vers le pancréas, tandis qu'on fait sortir l'extrémité externe par une incision dans l'hypochondre droit après avoir suturé et péritonisé le cholédoque. Guérison sans réaction. Exit le 7/11 1944.

(KJ 3250/44) J W J, agriculteur, 52 ans

Douleur épigastrique après les repas datant de 20 ans. A maigri de 7 kg en peu de temps. La radiographie du 7/11 1944 montre une déformation prononcée du bulbe duodénal avec niche de la grosseur d'un noyau de cerise vers le pancréas et des phénomènes de rétention stomacale au bout de 4 heures.

Le 9/11 1944 Résection de l'estomac suivant la méthode FINSTERER—POLYA—MAYO—(l'auteur). Rachianesthésie au moyen d'une solution diluée de percaïne. Incision médiane dans l'épigastre. Le bulbe duodénal est déformé par une tumeur de la grosseur d'un œuf de poule avec une épaisse cicatrice rayonnante sur sa face antérieure et plu-

sieurs petites loges sur la paroi correspondant à la petite courbure. Les canaux biliaires sont pris dans la tumeur formée par l'ulcère et paraissent enfouis dans la partie la plus couenneuse. Toute la tumeur est fortement adhérente au pancréas. Après avoir ponctionné le cholédoque et l'avoir ouvert au moyen d'une petite incision, on introduit jusque dans le duodénum une sonde demi-molle No 6. Avec la sonde comme guide, on isole circulairement le cholédoque dans sa partie inférieure. Lorsqu'on tente de découvrir la paroi postérieure, on arrive dans le duodénum, que pour cette raison on sectionne à cet endroit. On prépare ensuite le fragment inférieur en se guidant par la palpation exacte de la sonde placée dans le cholédoque, on le suture et on l'invagine suivant le procédé habituel et on péritonise. Ensuite, on dissèque la tumeur, on lie les vaisseaux de la grande et de la petite courbure et on achève la duodéno-gastrectomie et la gastro-anastomose suivant la méthode courante. On enlève la sonde du cholédoque qu'on suture. Suture abdominale.

Convalescence postopératoire sans rien de particulier. Le malade est congédié guéri le 27/11. Diagnostic anatomo-pathologique : ulcère calleux.

(KJ 126/45) Ott Ev S, commerçant, 40 ans. Entré à l'Hôpital le 3/1 1945.

Traité en 1932 et 1937 dans la division médicale pour ulcère du duodénum (journ. méd. 950/37), la radiographie montrait distinctement l'existence d'un ulcère. Depuis, douleurs avec paroxysmes périodiques, récemment il s'y est ajouté des vomissements. Radiographie le 6/6 1944, le duodénum est déformé en feuille de trèfle avec une niche d'ulcère de la grosseur d'un grain de café.

Le 4/1 1945 Duodéno-gastrectomie et gastro-anastomose suivant FINSTERER—POLYA—MAYO—(l'auteur). Rachianesthésie. Incision épigastrique. Conformément à l'image radiographique, on trouve sur la paroi antérieure du bulbe duodénal une cicatrice scléreuse faisant partie d'une tumeur de la grosseur d'un pruneau adhérent solidement au pancréas et dans laquelle on reconnaît à la palpation la présence d'une niche grosse comme l'extrémité du pouce. Les canaux biliaires sont pris dans la tumeur et le tissu inflammatoire. Après avoir découvert le cholédoque, on y passe deux sutures de fixation, on incise entre elles et l'on introduit un cathéter de gomme fin et mou. Mais il se plie à plusieurs reprises et il est impossible d'atteindre le duodénum, on recourt alors à une sonde de gomme demi-molle que l'on réussit après quelque difficulté à introduire en exerçant une pression suffisante pour forcer le rétrécissement du canal causé par la tumeur. On découvre les parties de la grande et de la petite courbure voisines du pylore après avoir lié les vaisseaux et l'on pose la pince. Puis, après ligature, on dissèque la tumeur ulcéreuse et le duodénum au-dessous de la tumeur, sous contrôle palpatoire répété de la sonde du cholédoque. On sectionne le duodénum au-dessous de la tumeur, on prépare encore un fragment de celui-ci, après quoi on suture légèrement le moignon qu'on invagine. Là-dessus, on continue à détacher du

pancréas la partie supérieure de la tumeur et l'on poursuit la résection selon le procédé courant, suivant une ligne passant au-dessus de l'angle sur la paroi correspondant à la petite courbure. On suture le cholédoque après avoir éloigné la sonde. On pose le drain que l'on fait sortir sous le rebord costal droit et l'on saupoudre la suture abdominale de poudre de sulfatiazol. Le fragment enlevé qui mesurait 210 cm<sup>2</sup>, portait un ulcère calleux avec niche, sclérose accusée et étranglement du bulbe.

Guérison sans complications. Congédié guéri le 10/1 1945.

(KJ 559/45) H. J., 59 ans. Entré à l'Hôpital 13/2 1945.

Troubles stomacaux depuis plus de 30 ans. A consulté plusieurs médecins et suivi plusieurs traitements diététiques. La radiographie du 10/2 1945 montre sur la paroi postérieure du bulbe duodénal, au-dessous du pylore, une niche d'ulcère de la grosseur d'un pois. 15/2 1945 Duodéno-gastrectomie et gastro-anastomose suivant FINSTERER—POLYA—MAYO—(l'auteur). Rachianesthésie avec solution diluée de percaine. La tumeur forme un gâteau dur, sclérosé, de la grosseur d'un pruneau, dans la région du bulbe duodénal dont la masse a déplacé et étranglé le duodenum et les canaux biliaires. On pratique la cholédochotomie et l'on introduit une fine sonde de gomme demi-molle jusque dans le duodénum. Après avoir posé une suture de fixation dans les parois du duodenum correspondant à la grande et à la petite courbure, *au-dessous* de la tumeur, on incise la paroi antérieure du duodenum sans cesser de s'orienter sur la position de la sonde du cholédoque. On saisit la paroi postérieure du duodenum avec une pince et au moyen de quelques coups de bistouri et l'introduction, entre elle et le pancréas, d'une paire de ciseaux mousses dont on écarte les branches, on détache comme d'habitude la paroi postérieure du duodénum des tissus environnants. On peut ensuite facilement suturer et invaginer le moignon, après quoi on pratique une seconde série de quelques sutures posées entre le tissu couenneux du pancréas et la paroi antérieure du moignon duodénal vers le bas. En se guidant sur la sonde on continue ensuite la résection en détachant du pancréas l'ulcère pénétrant et le segment pylorique du duodenum. On cauterise le tissu pancréatique découvert et on ligature à la soie. On éloigne la sonde, suture et péritonise l'incision du cholédoque. On pose un drain fenêtré vers le trou de Winslow et on le fait émerger sous le rebord costal droit. On poursuit ensuite la duodéno-gastrectomie vers le haut sur l'estomac et l'on exécute l'anastomose suivant le procédé habituel.

J'ai utilisé cette technique dans 8 cas qui ont tous quitté l'hôpital guéris. Il ne s'est jamais produit de lésions involontaires des canaux biliaires ou pancréatiques, l'écoulement de bile du cholédoque ou du moignon duodénal ne nous a jamais non plus causé le moindre désagrément en cours d'opération. Nous n'avons eu à noter aucune complication dans le cours de la convalescence après l'opération.

La même méthode a été utilisée pour l'opération de volumineux diverticules duodénaux. Cette méthode *ouverte* a facilité beaucoup la dissection, d'autre part, le fait de pouvoir de temps à autre s'assurer que les canaux biliaires n'ont pas été involontairement lésés et n'ont pas été pris dans les ligatures donnent un grand sentiment de sécurité. Les conditions dans lesquelles on intervient ici sont les mêmes que lorsque pour des interventions gynécologiques difficiles ou des opérations de carcinome du rectum, on opère après introduction de catéters dans les uretères.

Aucun des cas n'a présenté la moindre réaction et l'on n'a noté aucun inconvénient résultant de l'introduction du catéter (sonde) dans le cholédoque. La durée de l'opération des cas présentant de sérieuses difficultés techniques a été en outre considérablement diminuée, il a suffi en général d'1 à 1½ heure pour exécuter toute l'opération.

### Résumé.

L'auteur expose une technique opératoire qu'il emploie depuis longtemps dans les tumeurs péri-ulcéreuses compliquées et autres affections analogues de la partie supérieure du duodénum. Elle convient surtout dans les cas de grosses tumeurs calleuses péri-ulcéreuses qui ont pénétré la paroi duodénale postérieure et où les conduits biliaires ont été pris dans le tissu inflammatoire, de sorte que l'on est très exposé à les léser lors de la résection.

La technique consiste à introduire un catéter fin de consistance moyenne dans le cholédoque, au-dessus du ligament hépatoduodénal, à côté ou au travers de la tumeur, jusque dans le duodénum. On sectionne le duodénum *au-dessous* de la tumeur. La palpation pratiquée par l'index gauche introduit par le trou de Winslow pendant la dissection subséquente de la paroi duodénale postérieure et l'ablation de la tumeur elle-même, est un nouveau facteur de sécurité qui permet d'éviter des lésions involontaires des canaux biliaires et pancréatiques. L'auteur a utilisé cette méthode dans 8 cas où l'ablation était difficile, ils ont tous guéri complètement sans aucune complication durant la convalescence post-opératoire.

### Summary.

The author gives an account of the operative technique which he has used for a long time with tumorous ulcers and such like in the upper part of the duodenum. It especially concerns cases with large callous tumorous ulcers which have penetrated the posterior wall as well as those where the gall ducts are severely involved in the inflammatory changes in such a manner that they are in great danger of being damaged during resection.

The technique consists of passing a fine semi-hard rubber catheter into the choledochus above the ligamentum hepatoduodenale past the tumor down into the duodenum. The duodenum is incised (aborally) below the tumor. By palpating with the left forefinger from Winslow's foramen, one can accordingly, during the dissection of the posterior duodenal wall as well as during the subsequent excision of the ulcerous tumor, protect more surely the gall and pancreatic ducts from damage. The author has employed the method in 8 cases which were technically difficult to excise all of which were discharged fully cured without any postoperative complications.

### Zusammenfassung.

Verf. berichtet über die von ihm seit langem verwendete Operationstechnik bei schwierigen Ulkustumoren u. dgl. der oberen Partie des Duodenums. Es handelt sich besonders um Fälle von grossen kallosen Ulkustumoren, die die Hinterwand penetrieren und die wo die Gallengänge von den entzündlichen Veränderungen stark mit betroffen sind, so dass sie grosse Gefahr laufen, bei der Resektion verletzt zu werden.

Die Technik besteht darin, dass von oben, vom Lig. hepatoduodenale her, ein feiner, halbfester Gummikatheter in den Choledochus und am Tumor vorbei in das Duodenum hinab geführt wird. Das Duodenum wird unterhalb (aboral) vom Tumor durchtrennt. Durch Palpation mit dem linken Zeigefinger vom Foramen Winslowi aus lassen sich darauf, bei der nachfolgenden Freipreparation der hinteren Duodenalwand und der späteren Abtragung des Ulkustumors selbst, die Gallen- und Pankreasgänge in viel zuverlässiger Weise vor Verletzung schützen. Verf. hat diese Methode bei 8 technisch schwerrezezierbaren Fällen verwendet, die sämtlich völlig geheilt entlassen wurden, ohne irgendwelche Komplikationen des postoperativen Verlaufs.

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**A.-B. NORDISKA BOKHANDELN**

DROTTNINGGATAN 7 0 9

STOCKHOLM

*Största lager av svensk  
och utländsk litteratur*

**AVDELNING FÖR  
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läkare

**A.-B. NORDISKA BOKHANDELN**

From the Surgical Department of the Sabbatsberg Hospital  
(Chief Surgeon IVAR PALMER, M D)

## A Peculiar Bone Tumor.

Case Report of a Condition Described Previously in the Literature  
under the Name Osteoid-Osteoma or Corticalis Osteoid

By

IVAR PALMER

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The condition in question consists of a local bone lesion which causes a severe incapacitating pain that disappears with the surgical removal of the lesion. The histologic picture is complicated, and the genesis of the condition is not clearly understood.

JAFFE in 1935 is the only worker to have published any cases which correspond in all respects to the one described herein.

A 32-year-old engineer suffered for four years from increasingly severe pain in the anterior aspect of the right foot. At the outset the pain, which was of a cutting, boring type, only bothered the patient in the morning, but later on it also troubled him at night, keeping him from sleeping. His working capacity was considerably impaired. The patient thought he could observe a swelling over the instep following physical exertion. He had no memory of any trauma. During the course of the years he consulted several different physicians, who prescribed various remedies, including arch supports, but none of them gave him relief.

When the patient visited me four years after the onset of the symptoms, his foot was apparently completely normal without deformity or insufficiency. Palpation of the collum tali disclosed intense tenderness over a fingertip-sized area, and an exceedingly small swelling seemed to be perceptible. The tenderness was so intense that the patient kicked out involuntarily when the area was touched.

Roentgenograms of the bones of the foot showed a small change, which was difficult to interpret. Below the neck of the talus and in front of the inner malleolus could be seen a few small thorny bone processes, but no change could be detected in the spongy tissue of the neck of the talus.

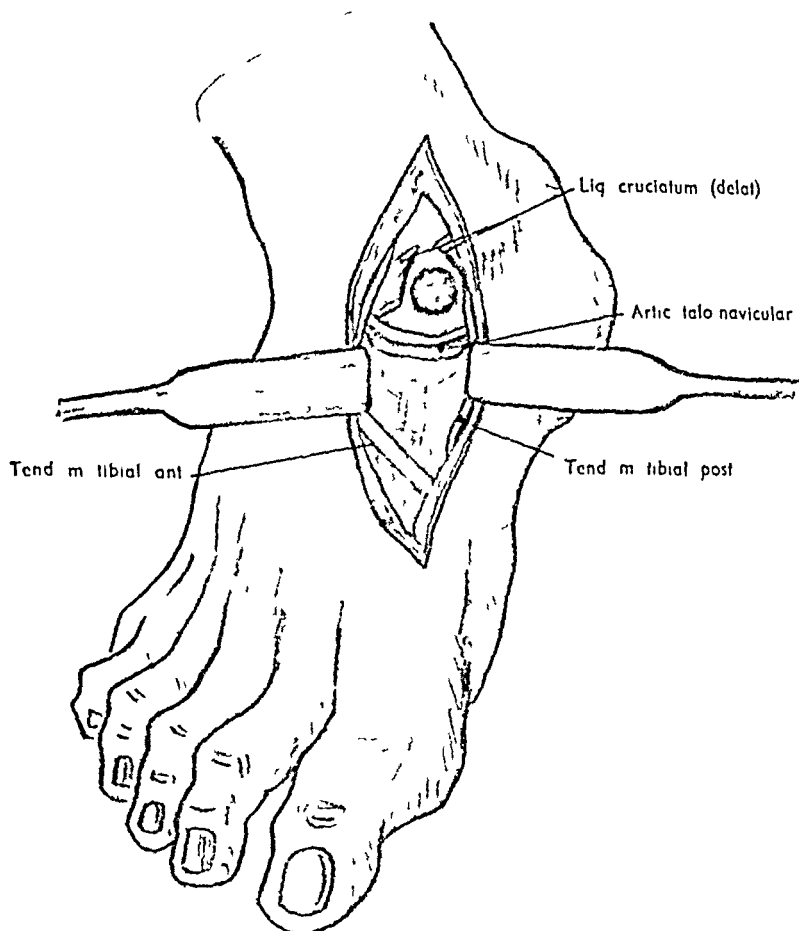


Fig 1

The Wassermann reaction was negative, and the blood picture was normal. The sedimentation rate was 4 mm in one hour.

Due to the severity of the symptoms and the distinct localization of the pressure tenderness, it was decided to make an exploratory incision. Glomus tumor was considered the most likely answer to the question.

The incision was made over the tender area between the inner malleolus and the anterior tibial tendon. When the anterior capsule of the talocrural joint, which covers the neck of the talus at this point, was exposed, it was found to be slightly edematous with translucent, grey-red discoloration. When the capsule was divided and the collum tali revealed, a spherical elevation was seen covering an area about one centimeter in diameter on the anterior aspect of the collum tali. The elevation consisted of a parchment-thin layer of cortical tissue over a translucent grey-red foundation (Fig 1). On entering the outer border of this area, the bore met a barrier of sclerotic spongy tissue comprising

a hazelnut-sized tumor, which was lifted out in one piece. The small, roentgenologically visible proliferations were discovered in the periphery of the tumor.

The histologic examination disclosed spongy bone tissue containing a rounded core, which was made up of an abundance of osteoid tissue with an unusually large number of rather wide blood vessels. This osteoid tissue was surrounded by extremely cellular connective tissue, which in addition to elongated spindle cells also contained many multinuclear giant cells. In the periphery of the core could be seen numerous newly formed bone lamellae surrounded by fine examples of osteoblastic rows (Fig. 2).

### Literature.

The first cases comparable with the one under discussion to be found in a survey of the literature on more or less similar conditions are the two described by BERGSTRAND in 1930. There, however, it was a question of *diaphyseal* processes situated in the basal phalanx of the little finger and in a metatarsal bone. The histologic examination revealed an osteoid lesion situated eccentrically in the compact tissue, which gave the diaphysis the form of a spindle. The center of the lesion consisted of an amorphous mass. It was surrounded by a fairly broad zone rich in vessels and by tissue interwoven with bony trabeculae. Between the vascular lumina and the amorphous mass could be seen large cells rich in protoplasm and with large bladder-shaped nuclei.

With regard to the genesis of these formations, BERGSTRAND was of the opinion that they were neither inflammatory processes nor tumors. He interpreted them as rests of embryonal avulsions. The homogeneous central core he regarded as embryonal cartilage, in which the cells had disappeared through regressive changes. The core, he believed, had been vascularized from the surrounding tissue and become reorganized. If left to itself it would gradually disappear, according to BERGSTRAND.

Meanwhile, JAFFE and MAYER in 1932 published a case in which a histologically identical formation was extirpated from the fourth metacarpal bone in a 15-year old girl. This formation, which corresponded in all clinical respects with an expansively growing tumor, reached a volume of  $10 \times 6 \times 6.5$  cm during a period of observation of three years. JAFFE and MAYER considered there was no doubt whatever that the formation was a tumor. They wanted to classify it as an "osteoid-chondroma" in conformance with a tumor type described by VIRCHOW in 1863.

In 1935 JAFFE published another group of not less than five cases, all of which had much the same histologic character. However, tumors of the spongy substance varying from pea to hazelnut-sized were involved in these cases. The sites of the tumors were the following: collum tali, calcaneus, inferior epiphysis of the fibula, spinous process of a cervical vertebra, terminal phalanx of a toe. Roentgen examination disclosed in all the cases a circular zone of sclerotic bone surrounded by a clearer zone, there was a dense core in the center of the clearer zone in four of the cases (fig. 3).

The histologic picture in these cases also corresponds with that of BERGSTRAND's two cases. The central osteoid mass displayed massive calcification in two of the cases, however, and peripherally this calcified nucleus turned into atypical lamellar bone. Attention was drawn to the fact that the intertrabecular stroma contained no hematopoietic medullary tissue nor fat, but only cellular tissue.

In all the cases mentioned so far, the change consisted of a lesion in the spongy substance or in short tubular bones. The correspondence between the cases was so good that there seemed to be no reason to suspect that different conditions were involved.

Meanwhile, MOBERG in 1941 published a series of eight cases, two of them his own, of similar lesions which, however, were situated in the metaphyses of long tubular bones (humerus, ulna, radius, femur, tibia). The lesions in these cases were not entirely recognizable either roentgenologically or histologically. The dominant feature was an elongated, diffusely outlined cortical thickening consisting of very dense, sclerotic bone. In one part of the deposit there could be seen a small bean-shaped clearer area of indefinite outline. In the operated cases this area was found to consist of osteoid tissue in the process of reorganization, thus corresponding with the formations described by both BERGSTRAND and JAFFE. In two cases cultures were made of the tissue in the central core in order to determine whether an inflammatory process was present, but no growth was secured.

### Discussion.

We are faced with a local skeletal change, the nature of which we do not understand. The first question to present itself is whether my case, JAFFE's case of "osteoid-osteoma" and BERG-



Fig 2



Fig 3



STRAND's and MOBERG's cases of "corticalis-osteoid" really were examples of the same condition. The cases in which the lesions were located in the spongy substance and the short tubular bones differ greatly from those in which they were located in the long tubular bones. JAFFE's first case was a very big formation of expansive growth. In his later cases and in my case the formations also grew expansively, compressing or displacing the surrounding bone tissue.

MOBERG's cases, on the other hand, in which the changes were situated in the diaphysis of long tubular bones, showed a very small, diffusely outlined osteoid lesion, while the periosteal reaction, with an extensive though relatively thin deposit of sclerotic bone superiorly, dominated the picture.

Was the difference in structure determined exclusively by a difference in the reaction of the bone tissue in spongy substance, short tubular bones and long tubular bones? Common to all the cases described were the following characteristics:

- 1) The condition appeared at an early age, most of the patients were between 10 and 20 years old. My patient, who was the oldest, was 28 years.

- 2) The condition was manifested by pain, which gradually grew in intensity. The pain was most severe at night.

- 3) The histologic findings in all the cases consisted of a focus of osteoid tissue, with peripheral vascularization and atypical bone formation with cellular intermediate substance and without hematopoietic tissue or fat medulla.

As appears above, the similarities are rather great, but the differences are also considerable. At this point it is probably futile to discuss the genesis of the condition, unless one confines oneself to the peculiar new spongy growth described earlier by JAFFE and now by the writer.

It can be said definitely that these formations were not inflammatory processes of septic, tuberculous or syphilitic origin. Nor did the histologic picture correspond with a giant cell tumor undergoing reorganization or with osteitis fibrosa localisata. It is difficult for a clinician to believe that it was a question of an ordinary reorganization process of an embryonic cartilage avulsion. Cartilage rests in the epiphyses of the long tubular bones, which gradually become ossified to normal spongy substance of slightly more than normal density, are a well-known incidental roentgenologic finding. They give no symptoms and are without

clinical significance. Histologically, however, the formation in no way resembles a tumor in the ordinary sense of the word. The skilful arrangement of the layers of tissue is more reminiscent of a malformation of the cartilaginous exostosis type.

Meanwhile, the condition under discussion is a clinically distinct complaint, which can be diagnosed by the long anamnesis, the typical pain, the local palpation tenderness when the growth is superficial, and the roentgen findings. The condition is well-suited to surgery. The circumstance that so many cases have been collected by the same person indicates that the condition is not a rarity.

### Summary.

An operated case of 'osteoid-osteoma' in the collum tali is described. The genesis of the formation is obscure. It gives a distinct clinical picture, however, and is easily accessible to surgery.

### Zusammenfassung.

Verf. beschreibt einen operierten Fall von »Osteoidosteom« im Collum tali. Die Genese desselben ist umstritten. Es gibt jedoch ein markantes klinisches Bild und ist chirurgischer Behandlung leicht zugänglich.

### Résumé.

L'auteur décrit un cas d'ostéome ostéoïde au col du calcaneum. L'origine du néoplasme est contestée. Mais il possède une image clinique nette et il est très accessible au traitement chirurgical.

### Literature.

BERGSTRAND. Über eine eigenartige, wahrscheinlich bisher nicht beschriebene osteoblastische Krankheit in den langen Knochen der Hand und des Fusses. *Acta Radiol.* 11, 1930. — JAFFE & MAYER. An osteoblastic osteoid tissueforming tumor of a metacarpal bone. *Arch. of Surg.* 24, 1932. — JAFFE. Osteoid-osteoma. A benign osteoblastic tumor composed of osteoid and atypical bone. *Arch. of Surg.* 31, 1935. — MOBERG. Die corticalis-osteoid, ein differentialdiagnostisch interessanter Typus von lokalisierter Skelettveränderung. *Arch. f. klin. Chir.* 202, 1941.

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## Caput Necrosis after Traumatic Dislocation of the Hip Joint in a 4-Year Old Boy, and Control Examinations of 8 Cases of Luxatio Coxae Traumatica.<sup>1</sup>

By

SV QUIST-HANSEN

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In some cases of traumatic lesion of the hip, a complication may develop which we call necrosis capitis femoris. The necrosis may develop after fractures, dislocations, and even after contusions of the hip (FRUND 1936). The operative treatment of fract colli femoris and the peritrochanteric fractures has led to more exact control of the patients, so there is now a rather large material of caput necroses in connection with these traumata. The situation is different as regards traumatic dislocation of the hip joint.

Traumatic dislocation of the hip joint is relatively rare, and was previously assumed to comprise about 2 % of all dislocations. The rising number of traffic accidents has in recent years caused an increase, especially in the form of the so-called "Dash-board" dislocations, and their frequency is now placed at about 5 % of all dislocations. Among 120 traumatic dislocations treated at the surgical department of Bergen's Municipal Hospital in the period 1927—1941, there were 10 dislocations of the hip joint, i.e. 8.5 %. These 10 dislocations were distributed among 23,600 admissions, i.e. 1 in about 2,400. For comparison it may be stated that during the same period 364 cases of fract colli femoris were treated.

Histological examinations by MÜLLER (1924), BONN (1924),

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<sup>1</sup> A preliminary report was presented at a meeting of The Medical Association of Bergen's Municipal Hospital on June 3, 1942.

PHEMISTER (1934), POTTS and OBLETZ (1939) have demonstrated that caput necrosis after traumatic dislocation of the hip joint is an aseptic, ischaemic necrosis of the same nature as in malacia ossis lunati, and ossis navicularis pedis. The vessel supply to the caput femoris has therefore been the object of numerous investigations which have shown that the caput is supplied by arteries in the lig. teres femoris and in the synovial membrane of the intra-articular part of the collum femoris, capsula reflexa. In fully grown individuals the two vessel areas anastomose through the spongiosa of the caput and the collum, and the spongiosa vessels make the caput more independent of the capsule arteries. In individuals in the growing age however, NUSSBAUM (1924) finds no such anastomoses, while STEWART's investigations (1933) show that they are present in some cases. It is however certain that there is a decided difference in the situation before and after the closing of the epiphysis line, which occurs in man at the age of 18—20 years.

On section, WILTE (1929) has in 12 cases of traumatic dislocation of the hip joint, found extensive, sometimes circular lesions of the capsule analogous to those we know can lead to necrosis of the caput femoris in animal experiments (NUSSBAUM 1926, ZEMANSKY and LIPPMANN 1929, STEWART 1933). In every complete dislocation of the hip the lig. teres femoris is torn, and the caput is thus deprived of the blood supply carried by the arteries which have then course there. Investigations by CHANDLER and KREUSCHER (1932) and by NORDENSON (1936) have supported many earlier findings of abundant vessel supply in many cases through the lig. teres femoris even in fully grown and mature individuals, but with considerable individual variations within the different age groups. In 1934 WALDENSTROM reported that necrosis of the caput had developed in 3 cases of epiphyseolysis capitis femoris after operative treatment, where the lig. teres femoris was cut over in 2 and injured in the 3rd during the operation. In 2 cases where the lig. teres femoris was maintained intact there was no necrosis of the caput in spite of the fact that the caput epiphysis was loosened from its connection with the collum and replaced. It is thus clear that the blood supply of the caput femoris can be assured through the lig. teres femoris. This is also illustrated by SCHMORL's case (1924) of fract. colli femoris in a young person (age not recorded).

In cases of traumatic dislocation of the hip joint the extent of the ischaemic necrosis of the caput femoris will be dependent on

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In cases of traumatic dislocation of the hip joint the extent of the ischaemic necrosis of the caput femoris will be dependent on

Table 1.

Age in years	1	2	3	4
	Traumatic luxation of the hip	Caput necrosis	Traumatic luxation of the hip	Caput necrosis
0—5	6	2		
6—10	10	6	20	7 + 1
11—15	8	5		
16—20	20	9	37	18
21—25	25	4		
26—30	32	2	110	6
31—35	26	3		
36—40	17	1	76	4
41—45	19	2		
46—50	30	4	73	8
51—55	22	3		
56—60	15	1	47	5
60	5		7	
	235	42	370	48 + 1

By comparing the distribution in the two pairs of columns, 1 and 2 and 3 and 4 we can, in consideration of the scantiness of the material only make an arbitrary evaluation of the necrosis frequency in the individual age groups the necrosis risk, as presented in the form of a curve in Fig. 1

There is good agreement between the two curves, i.e. the increase in the number of cases of necrosis from 42 to 49, and the number of luxations from 235 to 370 has not led to any considerable change. We find a high necrosis frequency in ages under 20 years, a rapid drop in the 21—25 year old group to a minimum at the ages 26—30 with a slight increase from 50—60 years.

At the same time as the necrosis frequency is high under 20 years of age, the number of total necroses is also considerably higher than in the more advanced age groups. In 13 of the 25 patients under 20 years of age the necrosis was total, as BLUMENSAAT (1936) states is always the case in the ages from 6—23 years. In 7 of the 25, however, there is a partial necrosis. The anatomical investigations indicate that there is considerable individual variation in the relative significance of the arteries of the lig. teres femoris and those of the capsule for the supply of the caput, and with the varying degrees of the capsule lesion it is difficult to assume that partial necroses should not also occur in the ages 6—23 years.

Traumatic dislocation of the hip joint in ages under 5 years is very rare, and in the literature I have not found more than one case of caput necrosis in this age group, a case reported by ELMSLIE in 1923 I shall therefore describe a case which has been under observation for  $2\frac{1}{2}$  years, since June, 1941

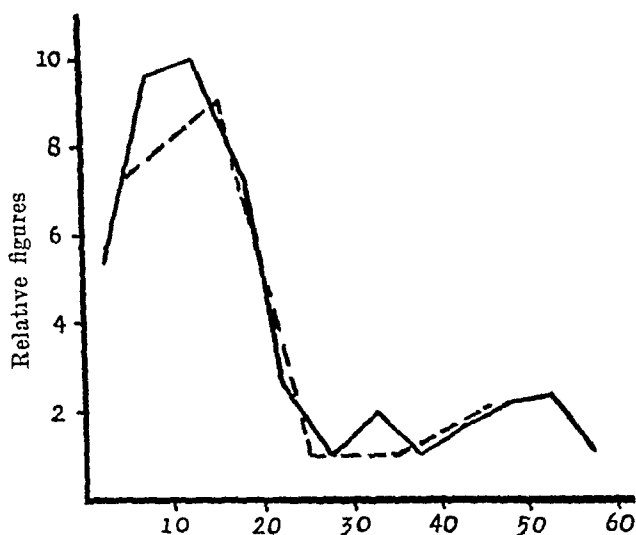


Fig 1 The age distribution of 42 (—) and 49 (---) cases of caput necrosis in relation to the age distribution of 235, respectively 370 cases of traumatic dislocation of the hip joint

R K Born  $24\frac{1}{5}$  1937 When 3 years and 11 months old he was  $24\frac{1}{6}$  1941 caught in a stony slope A stone fell against the inside of his right thigh, the boy sat down but the upper part of his body fell forward to the left and his right hip came out of joint Roentgen examination 3 days later revealed a luxatio iliaca (Fig 2) Acetabulum well developed Collum and caput normal Reposition under anaesthetic with no difficulties He was up and about after 14 days and the function of the right hip was perfectly normal

Four and a half months after the injury he gradually began to limp On  $11\frac{1}{1}$  1942, almost 8 months after the dislocation, the motility of the right hip was found to be slightly reduced, especially abduction Roentgen examination revealed that the caput femoris was compressed with increased calcium concentration in relation to the surrounding bone The patient was sent to bed for a month with a 2 kg traction When he got up at the end of March 1942 he limped more than before

On examination  $31\frac{1}{2}$  months later,  $23\frac{3}{4}$  1942 he had a pronounced lumbar lordosis and limped slightly with the right leg Trendelenburg+ on the right side Atrophy of right thigh and nates Right leg slightly rotated outward and with  $10^\circ$  flexure contraction in the hip Flexure, abduction and inward rotation were reduced Roentgen examination (Fig 3) showed only slight changes since  $11\frac{1}{1}$  1942 Acetabulum well developed Caput femoris considerably reduced, compressed and with

increased calcium content in relation to the surrounding bone. The limitation along the epiphysis line somewhat irregular and uneven. The thickness of the cartilage in the joint is increased, and the distance between the caput and the base of the acetabulum is greater than on the healthy left side. The epiphysis line seems to be of normal height. On both roentgen pictures the right femur is rotated outward more than the left, and the short, thick right collum is probably a result of this difference in projection. R. Total caput necrosis in the right hip.

On control  $4\frac{1}{11}$  1942, 17 months after the injury, it was stated that the boy limped less than he had done some time before. After strenuous walking the right hip tired, but otherwise it did not bother him. However he now limped more than on the examination 6 months previously, and movement of the pelvis when walking was more pronounced. The atrophy of the right thigh and nates was unchanged. Abduction in the right hip no longer possible. Otherwise mobility was the same as  $2\frac{3}{4}$  1942. Roentgen examination (Fig 4) showed that the thickness of the cartilage in the joint and the distance between the remains of the caput and the base of the acetabulum were further augmented. All that remains of the caput is a series of irregular, unevenly limited and unevenly calcified fragments with a high calcium content, separated from the collum by a narrow and somewhat irregular epiphysis line. The right femur is rotated outward and the collum appears short and thick.

On  $2\frac{1}{2}$  1944,  $2\frac{1}{2}$  years after the injury, it was stated that this condition was unchanged the first 6 months after the examination of  $4\frac{1}{11}$  42 but that the boy during the past 6 months had been much better. His movements were freer and easier, and he limped much less than  $1\frac{1}{4}$  years previously, but the pelvis still moved considerably when he walked. Trendelenburg + right side. The atrophy of the right thigh and nates unchanged. Right leg in normal position. No hyperextension. Flexure normal. Abduction increased to  $15^\circ$  and there was increase of both inward and outward rotation. The roentgen examination (Fig 5) shows the subluxation position and the increased cartilage thickness as in the previous examination on  $4\frac{1}{11}$  42. The collum is thick, and the breadth at the epiphysis line is increased. A broad, flat, caput mass is also visible now, considerably larger than on the previous examination. The surface is irregular, and the calcium concentration uneven with some very dense, grain-sized spots. R. Calvé-Perthes disease in the reconstruction stage.

A summary of this case history reveals that in a 4-year old boy there is a luxatio iliaca after marked flexure in the hip with an abducted and outwardly rotated femur, a mechanism well known from dislocation of the hip joint in mineis. After a symptomfree interval of  $4\frac{1}{2}$  months he begins to limp, there is reduced abduction and extension in the hip joint, and roentgen examination reveals a total caput necrosis. More than a year later abduction and extension are further reduced, and roentgen examination shows

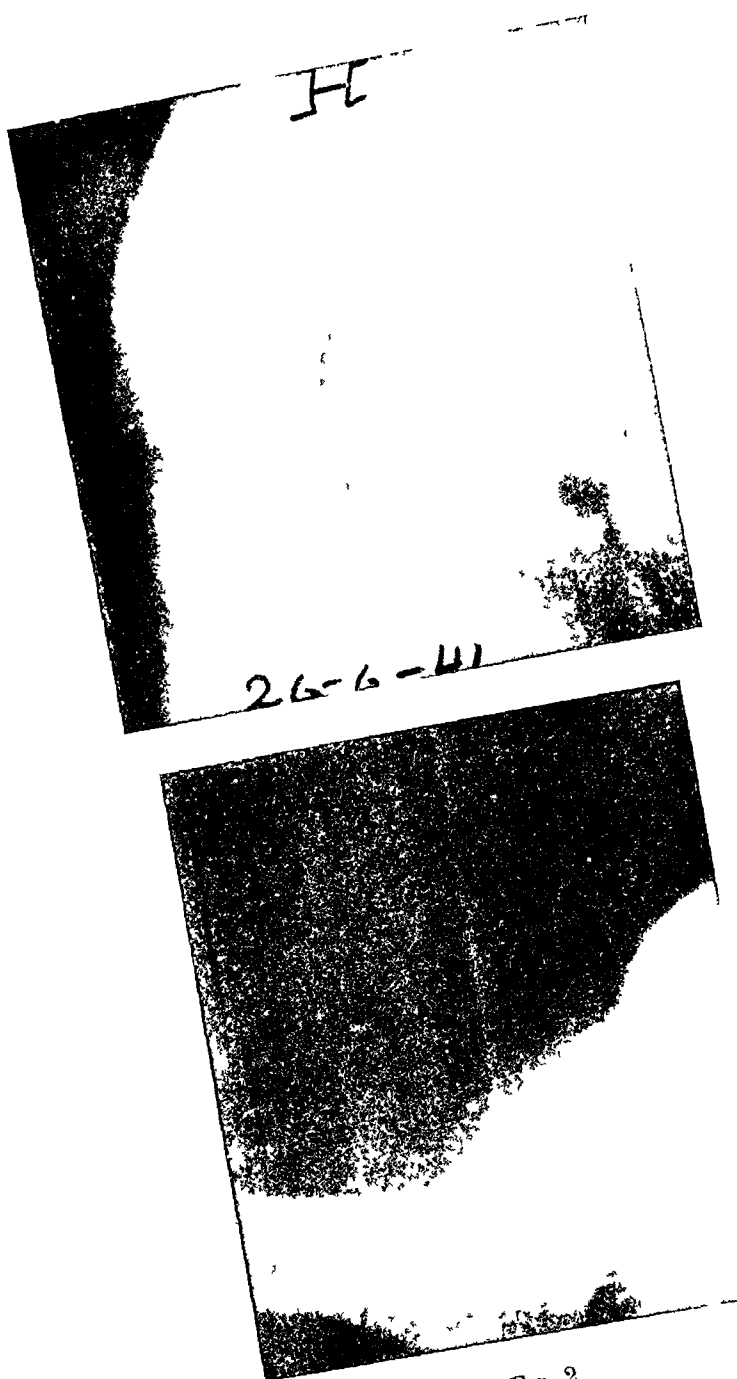


Fig 2

QUIST HANSSEN Caput Necrosis



Fig 3



Fig 4

QUIST HANSSON Caput Necrosis





tions of the hip joint comprised 8.5 % of all dislocations during the years 1927—1941

In individuals in the growing period, the tearing over of the lig. teres femoris and the more or less extensive capsule lesion in a traumatic dislocation of the hip joint will lead to greater risk of ischaemia of the caput than is the case in full-grown individuals where the blood supply through the spongiosa of the collum to the caput makes it more independent of the blood supply through the lig. teres femoris and the capsule arteries.

Animal experiments (MULLER 1924) have demonstrated the high necrosis frequency in individuals in the growing period. A comparison between the age distribution of 370 cases of traumatic dislocation of the hip joint and the 49 known cases of caput necrosis after this injury, shows that in human beings also the risk of caput necrosis is great during the growing period with a rapid drop after the closing of the epiphysis line at 18—20 years of age.

There is presented a report of a case of caput necrosis after traumatic dislocation of the hip joint in a 4-year old boy, observed for 2½ years. Both clinically and roentgenologically the caput necrosis presented the picture typical for the course of Mb. Calve-Legg-Perthes.

A control examination of 8 cases of traumatic dislocation of the hip joint, of which 3 were under 10 years of age, revealed no signs of caput necrosis 2¾ to 20½ years after the injury, and none had any subjective symptoms.

### Zusammenfassung.

Als Häufigkeit der traumatischen Auslenkung des Hüftgelenks wird oft etwa 5 % aller Auslenkungen angegeben. In der chirurgischen Abteilung des Städtischen Krankenhauses in Bergen machten 10 traumatische Hüftluxationen 8.5 % sämtlicher Luxationen in den Jahren 1927—1941 aus.

Bei Menschen im Wachstumsalter werden die Zerreissung des Lig. teres femoris und die mehr oder weniger ausgedehnten Kapselverletzungen bei traumatischer Auslenkung des Hüftgelenks grössere Gefahren einer Kaputischie mit sich bringen, als es bei Erwachsenen der Fall ist, bei denen die Blutversorgung des Kaputs durch die Kollumspongiosa dieses von der Blutversorgung durch das Lig. teres femoris und die Kapselarterien mehr unabhängig macht.

Tierversuche (MULLER 1924) haben die hohe Nekrosefrequenz in der Wachstumsperiode gezeigt. Ein Vergleich der Altersverteilung von 370 Fällen von traumatischer Luxation des Hüftgelenks und der 49 bekannten Fälle von Kaputnekrose nach dieser Verletzung zeigt, dass auch beim Menschen die Gefahr einer Kaputnekrose im Wachstumsalter gross ist, um nach Schliessung der Epiphysenlinie im Alter von 18—20 Jahren rasch abzunehmen.

Es wird ein Fall von Kaputnekrose nach traumatischer Ausrenkung des Hüftgelenks bei einem 4jährigen Knaben beschrieben, der  $2\frac{1}{2}$  Jahre lang beobachtet wurde. Sowohl klinisch als auch röntgenologisch zeigte die Kaputnekrose das für den Verlauf des Morbus Calvé-Legg-Perthes typische Bild.

Nachuntersuchung von 8 Fällen von traumatischer Luxation des Hüftgelenks, von denen 3 unter 10 Jahre alt waren, ergab  $2\frac{3}{4}$  bis  $20\frac{1}{2}$  Jahre nach der Verletzung keine Anzeichen einer Kaputnekrose, und keiner der Patienten hatte subjektive Symptome.

### Résumé.

On estime d'habitude à 5 % du nombre total des luxations la fréquence des luxations traumatiques de la hanche. Les 10 cas de luxation de ce type observés à l'Hôpital Municipal de Bergen constituent le 8,5 % du nombre total des luxations entre 1927 et 1941.

Chez les individus en période de croissance, l'action de divulsion exercée par le ligament rond et la lésion plus ou moins étendue de la capsule dans une luxation traumatique de l'articulation de la hanche augmentent le risque d'ischémie de la tête du fémur tandis que chez les adultes, son irrigation sanguine par le tissu spongieux du col la rend plus indépendante de l'apport sanguin à travers le ligament rond et les artères de la capsule articulaire.

Des expériences sur l'animal (MULLER 1924) ont démontré la grande fréquence de la nécrose chez les individus en période de croissance. D'un examen de la répartition des 370 cas de luxation traumatique de la hanche et des 49 cas connus de nécrose de la tête fémorale à la suite de ce traumatisme entre les divers âges, on conclut que, chez l'homme aussi, le risque de la nécrose de la tête du fémur est grand dans la période de croissance, il diminue rapidement après ossification de la ligne épiphysaire entre 18 et 20 ans.

L'auteur rapporte un cas de nécrose de la tête femorale après une luxation traumatique de la hanche chez un garçon de quatre ans observé durant deux ans et demi. Tant du point de vue clinique que radiologique, l'image présentée a suivi le cours typique de la maladie de Calve-Legg-Perthes.

Un examen de contrôle de 8 cas de luxation traumatique de la hanche, dont 3 cas chez des malades au-dessous de 10 ans, n'a révélé aucun signe de nécrose de la tête du fémur, de 2 ans 9 mois à 20 ans 6 mois après le traumatisme, et aucun des cas ne présentait de symptômes subjectifs y relatifs.

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## Die Läsion der Bauchspeicheldrüse im Zusammenhang mit der Splenektomie und das Fieber nach dieser Operation.

Von

ERKKI SAARENMAA

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Das Fieber nach Splenektomie stellt unter den Komplikationen, denen man nach chirurgischen Eingriffen begegnet, eine interessante Erscheinung dar. Bekanntlich tritt bei dem Patienten nach jeder grosseren chirurgischen Operation, wie Stomektomie, Magenresektion usw., eine Temperatursteigerung auf, bei den einen eine unbedeutendere, bei den anderen eine sehr hohe. Aber dieses sogenannte Resorptionsfieber ist von kurzer Dauer. Postoperative Lungenaffektionen und Thrombophlebitiden sind die gewöhnlichsten Komplikationen, die die Ursache erklären, wenn der operierte Patient unerwartet lange anhaltendes Fieber bekommt. Ohne dass das Fieber als Resorptionsfieber gedeutet und ohne dass die beiden genannten hinzutretenden Erkrankungen festgestellt werden können, sieht man nach Exstirpation der Milz zuweilen Fieber auftreten, dessen Dauer sehr lange Zeit eine bis mehrere Wochen, umfassen kann. Dies kann eine sehr hohe, echte Hyperpyrexie sein. Wie oft ein derartiges Fieber nach Splenektomie vorkommt und welches seine Ursache ist, das sind zwei Fragen, die sich aufdrängen, wenn man den postoperativen Krankheitsverlauf verschiedener Splenektomien zu verfolgen hat. Obwohl es scheinen mochte, als wären die Heilungsaussichten dieselben, kann sich die Konvaleszenz bemerkenswert verschieden gestalten. Dasselbe gilt auch von der Prognose, manche Patien-

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<sup>1</sup> Wird mit Erlaubnis des Chefarztes der finnischen Wehrmacht, Sanitätsobsterr HEINONEN, veröffentlicht.

ten gehen uberraschenderweise im Zeichen einer Hyperpyrexie zugrunde

Was die erste Frage anbelangt, durfte gegenuber der Behauptung, dass die Hyperpyrexie in den meisten Splenektomiefallen vorkomme (TROLLE), ein Zweifel am Platze sein. Wird die Exstirpation der Milz unter vollig aseptischen Verhältnissen und ohne technische Schwierigkeiten ausgefuhrt, wie es z. B. bei dem hamolytischen Ikterus moglich ist, so unterscheidet sich der postoperative Krankheitsverlauf nicht von dem nach einer gewohnlichen Laparotomie (WEINERT). Aber nicht immer bestehen gunstige Verhältnisse. Bei schwierigen Situationen, wie bei Milzrupturen, thrombophlebitischen Splenomegalien, müssen wir wegen Blutungen und Verwachsungen aufs Geratewohl handeln und Massenligaturen anwenden. Dabei kann man einen Teil der Bauchspeicheldruse mitligieren und in einem Teil des betreffenden Organs eine Nekrose oder Gangran verursachen. v. HERCZEL fuhrt die Temperaturerhohungen auf kleine Nekrosen und Zirkulationsstorungen im Pankreas zuruck. Fettnekrosen entstehen nach v. HERCZEL und MICHELSSON auch aus Zirkulationsstorungen, da bei der Unterbindung der A. lienalis auch die Rami pancreatici ligiert werden. Als Beweis hierfur fuhrt v. HERCZEL zwei Falle an, in denen das Fieber ausblieb, als er bei der Operation die Blutgefasse exakt hervorpräparierte, indem er die A. lienalis nahe am Hilus unterband. Abgesehen von dieser anscheinend naturlichen traumatischen Lasion der Bauchspeicheldruse im Zusammenhang mit der Splenektomie, sind im Schrifttum auch grobere Komplikationen beschrieben worden. Am ernstesten sind Blutungen und Lasionen in der Magenwand oder im Perikard, die bei der Losung von Adharenzen besonders vom Zwerchfell entstehen konnen (FOWLER). BISCHOF hat einen Fall mitgeteilt, in dem er bei der Unterbindung der A. lienalis die A. colica media mitligierte. Infolge davon kam es zu einer Nekrose im Dickdarm von der Flexura lienalis bis zum S. romanum. Da die Rami gastrici breves abgebunden werden konnen, ist es moglich, dass die Blutungen im Verdauungskanal nach Splenektomie hiervon herruhren (LIEBLEIN). Manche Forscher bringen die Erscheinung mit einer venosen Stauung und einer Thrombenbildung im System der Vena portae in Verbindung (LOTSCH).

Ausser der obenerwahnten operativ-technischen Erklarung, vor allem der Lasion der Bauchspeicheldruse, sind auch andere Theorien uber die Ursachen des Fiebers nach Splenektomie aufgestellt

worden. Überdies sind umfangreiche Arbeiten über die Chirurgie der Milz erschienen, in denen die unmittelbare postoperative Konvaleszenz in diesem Sinn gar nicht beachtet ist (DEAN LEWIS). Im Gegensatz zu der Behauptung, dass die Patienten oft dieser mehrere Tage dauernden Hyperpyrexie erliegen (TROLLE), sagt SEBENING, die postoperative Heilungsdauer der Splenektomie sei zwar voller Komplikationsmöglichkeiten, aber das sogenannte Splenektomiefieber sei nicht von prognostischer Bedeutung. IPSEN meint, dass die Temperatursteigerung meist nur nach Exstirpation einer pathologisch vergrösserten Milz auftrete. Einige Forscher fassen das Fieber als eine Mangelerscheinung der Milz auf. Es werde z. B. durch die Proteinstoffe hervorgerufen, die die normale Milz aus dem Organismus eliminiert (HIRSCHFELD-MUHSAM). Nach SIMON solle der Wegfall der bakteriziden Wirkung der Milz bewirken, dass die Infektionsmöglichkeit des ganzen Organismus selbst gegenüber kleinen Infektionen stiege. Gegen diese Anschauungen spricht der Befund IPSENS, dass das Fieber auch in einem Fall auftreten kann, in dem die Nebennilz erhalten ist. Im allgemeinen wird die Auffassung als richtig betrachtet, dass die Resistenz des Patienten gegen Infektionen nach Exstirpation der Milz später nicht herabgesetzt ist (HEINEKE).

Die topographische Lage der Milz in der Nähe des Pankreas und der Verlauf ihrer Blutgefässe hinter dem Schwanzteil desselben sowie andererseits die enge Beziehung der Blutgefässe des Pankreas zu der V. lienalis und der A. lienalis machen es verständlich, dass eine Schädigung des Drüsengewebes und eine Hyperämie besonders in den Korpus- und Kaudateilen nach Unterbindung der Blutgefässe des Milzhilus sehr wohl möglich sind. Ziehen wir ausserdem die zahlreichen Anomalien in dem gegenseitigen Verhalten der Blutgefässe der Milz und der Bauchspeicheldrüse in Betracht, so ist es begreiflich, dass diese Komplikation möglich und mitunter unvermeidlich ist und dass die Schädigung sogar einen sehr grossen Teil von dem Drüsengewebe der Bauchspeicheldrüse betreffen kann. Ebenso klar ist aber, dass diese operationstechnische Komplikation nicht immer eintritt, weshalb es sich auf natürliche Weise erklärt, dass der postoperative Krankheitsverlauf nach Splenektomie ein ähnlicher wie nach jeder beliebigen aseptischen Operation sein kann.

Manche Forscher heben denn auch hervor, dass da die Bauchspeicheldrüse ein chirurgisch gefährliches, »operationsfeindliches« Organ ist, sich jeder Chirurg dessen bewusst sein müsse, dass er

z B bei der Exstirpation der Milz in der Nahe der Bauchspeicheldrüse arbeitet (CLAIRMONT, SEBENING, SCHAAACK) Ausser bei Operationen, die sich auf die Milz beziehen, besteht selbstverständlich auch bei anderen den Nachbarorganen des Pankreas geltenden chirurgischen Eingriffen die Möglichkeit, dass man eine Läsion ihres Drüsengewebes herbeiführt Dabei handelt es sich u a um Operationen an den Gallenwegen, dem Dickdarm und dem Magen Beispielsweise bei der Versenkung eines Duodenumstumpfes kann man die Versenkungsnahte so tief legen, dass das Drüsengewebe der Bauchspeicheldrüse verletzt wird SEBENING führt eine 145 Fälle umfassende Statistik von postoperativen Pankreaserkrankungen an, von denen 7 nach Milzexstirpation aufgetreten sind Dass nach Splenektomie so wenig Pankreaserkrankungen vorkommen, dürfte sich daraus erklären, dass die Exstirpation der Milz in der Friedenschirurgie selten ist, aber auch daraus dass leichte Läsionen nicht diagnostiziert werden Aus anatomischen Gründen hat eine bei Unterbindung des Hilus der Milz entstandene Pankreasläsion die besten Aussichten, sich allmählich zu begrenzen und resorbiert zu werden, ohne dass sie andere Symptome als ein ungewöhnlich lange dauerndes Resorptionsfieber gibt Beim Diagnostizieren leichter Schädigungen sollte mithin auch den Pankreatitis-symptomen im Blut und Harn Beachtung geschenkt werden Die schweren Pankreasläsionen können dagegen Pankreasnekrose, eitrige Pankreatitis, Pankreasabszesse und Pankreasfisteln hervorrufen In einer Untersuchung, die alle vor 1935 in Schweden ausgeführten Splenektomien wegen Milzkrankheit (zusammen 97 Fälle) umfasst, erwähnt BRANDBERG als Todesursachen u a eine operative Pankreasläsion, die bei der Sektion festgestellt worden war Einige Male ist, wie er angibt, die Todesursache in hohem postoperativem Fieber gefunden worden

Im vorliegenden werde ich einen Fall beschreiben, der gewissermaßen eine Zwischenform zwischen der von mir angenommenen leichten, nur Fieber verursachenden und der ernstesten, zum Exitus führenden operativen Pankreasläsion bildet Vorher aber ist es angebracht, kurz auf die Bauchspeicheldrüse selbst und auf ihre traumatischen Erkrankungen einzugehen Abgesehen von Kriegsschaden und operativen Läsionen, sind die traumatischen Erkrankungen der Bauchspeicheldrüse gewöhnlich durch stumpfe Gewalt verursacht Manchmal konnte, wenn durch stumpfe Gewalt die Cauda pancreatis und mit ihr der Ductus Wirsungi rupturiert

war, durch vollständige Entfernung dieses abgerissenen Teiles eine Heilung erzielt werden (SEBENING) Andernfalls entsteht eine Nekrose, die eine allgemeine Peritonitis hervorruft, oder die Nekrose begrenzt sich und wird von selbst resorbiert oder gibt Anlass zur Entstehung einer Pankreaszyste Die Pankreaszyste ist denn auch die häufigste Erkrankung nach einer subkutanen Pankreasverletzung Irgendwelche Defekterscheinungen in der Funktion der Drüse brauchen im Gefolge einer derartigen partiellen Pankreasnekrose nicht aufzutreten, wiewohl sie möglich sind Was das wichtigste Symptom der eigentlichen allgemeinen Pankreatitis, die erhöhte Diastasezahl im Blut und Harn (WOHLGEMUTH) betrifft, sind während des Fiebers nach Splenektomie erhöhte Diastasewerte konstatiert worden, die nach dem Absinken des Fiebers gleichzeitig auf die Norm gesunken sind (TROLLE) Die Untersuchung der Diastase stellt daher ein wichtiges diagnostisches Hilfsmittel dar, das nach jeder Splenektomie angewendet werden sollte Ausser der eigentlichen Läsion im Drüsengewebe selbst können wir durch Unterbindung der Milzvene eine Blutstockung in den Korpus- und Kaudateilen des Pankreas hervorrufen Das geschieht dann, wenn die Vv pancreaticae distal von der Unterbindungsstelle münden Nach Splenektomie kann offenbar vorübergehend eine ähnliche Situation entstehen wie bei Stenose der V lienalis, wenn die Vv pancreaticae distal von der Stenose münden Als Folge davon kann, wie durch den Zuckerbelastungsversuch nachgewiesen worden ist (FRANZAS), eine latente Hyperglykämie entstehen Eine manifeste Glykosurie habe ich in meinen später wiedergegebenen Splenektomiefällen nicht festgestellt.

In Kriegszeiten ist die Splenektomie eine viel häufigere Operation als in der Friedenschirurgie Sicher hat sich in unserem Winterkrieg und in dem vor kurzem abgeschlossenen Krieg zwischen Finnland und der Sowjetunion ein grosses Material von Milzexstirpationen angesammelt Dieses Material wurde sicher auch Licht über den postoperativen Verlauf der Splenektomien und auch über die in Rede stehende Fiebererscheinung verbreiten Es besteht bei uns jedoch noch keine Möglichkeit, dieses Material seinem ganzen Umfang nach auszuwerten Ausserdem ist zu bemerken, dass die Kriegsschaden oft so kompliziert und infiziert sind, dass sich nur wenige diesbezüglich beurteilen lassen Da ich in verhältnismässig kurzer Zeit 8 Splenektomiefälle zu behandeln und zu verfolgen gehabt habe und einer von ihnen (Fall 8) den Anlass zu dieser Darstellung gegeben hat, scheint es mir angezeigt

zum Vergleich kurz alle diese Fälle wiederzugeben, von denen 7 in einem Feldlazarett (Tiaumen) und 1 im Stadtischen Krankenhaus zu Tampere (pathologische Milz) behandelt worden sind. Die beschriebenen Kriegsschaden geben zugleich eine Auffassung davon, wie kompliziert sie sein können.

*Fall 1* Soldat N N Wurde im August 1941 durch einen Granatsplitter verwundet. Diagn. Vuln. bomb. penetr. thoraco-abdominale l sin. Ruptura lienis. Haemorrhagia intra-abdominalis. Therapie: Laparotomia Splenectomia. Wurde in einem Feldlazarett behandelt. Als Konvaleszent in ein Militärkrankenhaus evakuiert. Nach der Operation weder ungewöhnlich lange dauerndes Fieber noch kurz dauernde Hyperpyrexie.

*Fall 2* Soldat N N Wurde im August 1941 durch einen Granatsplitter verwundet. Diagn. Vuln. bomb. penetr. reg. hypochondrii l sin. Ruptura lienis. Haemorrhagia intra-abdominalis. Therapie: Laparotomia Splenectomia. Ubrige Organe der Bauchhöhle, Lungen und Pleurae unverletzt. Nach der Operation hohes Fieber (continua ad 40°). Am 5. Tage Exitus. Eine Sektion konnte nicht ausgeführt werden. War in einem Feldlazarett behandelt worden.

*Fall 3* Soldat N N (russischer Kriegsgefangener) Wurde im September 1941 durch ein Maschinenpistolengeschoss verwundet. Diagn. Vuln. sclopet. perf. reg. hypochondrii l sin. Ruptura lienis. Rupturae n. o. II coli transversi. Therapie: Laparotomia Sutura rupt. coli et splenectomia. Wurde in einem Feldlazarett behandelt und als Konvaleszent in ein Gefangenenkrankenhaus evakuiert. Nach der Operation weder ungewöhnlich langedauerndes Fieber noch Hyperpyrexie.

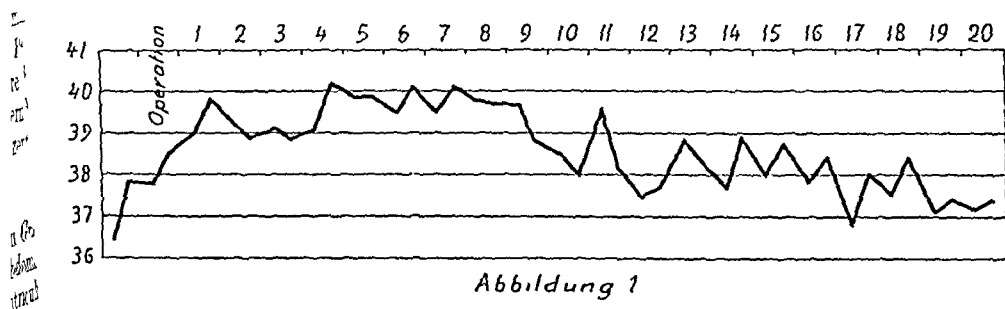
*Fall 4* Soldat N N Wurde im September 1941 durch einen Granatsplitter verwundet. Diagn. Vuln. bomb. penetr. thoraco-abdominal. Pneumothorax apert. l sin. Ruptura ventriculi et lienis. Haemorrhagia intra-abdominalis. Therapie: Seclusio pneumothoracis. Laparotomia Sutura rupt. ventriculi Splenectomia. Wurde in einem Feldlazarett behandelt. Exitus am folgenden Tage. Wegen der Schwere der Verletzung lässt sich die Todesursache nicht differenzieren.

*Fall 5* K H, 28jähr. Kochin, Tampere. Erkrankte im Sommer 1942. Diagn. Stenosis v. lienalis Splenomegalia. Therapie 5. 2. 1943 Splenectomia. Wurde im Stadtischen Krankenhaus zu Tampere behandelt. Nach der Operation weder ungewöhnlich langedauerndes Fieber noch kurzdauernde Hyperpyrexie. Wurde als Konvaleszentin entlassen und war bei späterer Untersuchung symptomlos.

*Fall 6* Soldat N N Wurde im Oktober 1943 durch einen Granatsplitter verwundet. Diagn. Vuln. bomb. penetr. thoraco-abdominale l sin. Pneumothorax apert. l sin. Ruptura permagna ventriculi

et henis Haemorrhagia intra-abdominalis Therapie Seclusio pneumo-  
thoracis Laparotomia Suturatio rupt ventriculi Splenectomia Wurde  
in einem Feldlazarett behandelt Exitus am folgenden Tage Wegen  
der Schwere der Verletzung lässt sich die Todesursache nicht differenzieren

*Fall 7* Soldat N N Wurde am 25 7 1944 durch einen Granatsplitter in der linken Seite verwundet Die Eintrittsoffnung des Splitters hatte sich geschlossen und war klein Wurde in einem Feldlazarett behandelt, in das er mit ganz weichen Bauchdecken eingeliefert wurde Anfangs begnugte man sich damit, den Zustand des Patienten zu verfolgen Am folgenden Tage begann er über heftige Bauchschmerzen zu klagen, und bei der Untersuchung wurde der Bauch aufgetrieben und ausserordentlich schmerzhaft, mit Défense musculaire, gefunden Therapie Laparotomia Splenectomia Diagn Vuln bomb penetr reg hypochondrii l sin Ruptura henis Haemorrhagia intra-abdominalis In diesem Fall hatte ein kleiner Splitter mit grosser Anfangsgeschwindigkeit (die Granate war unmittelbar neben dem Verwundeten niedergefallen) eine grosse Milzruptur verursacht, die später zu bluten anfang Die Voraussetzungen waren also günstig für einen aseptischen Verlauf der Laparotomie Es entstand auch keine Infektion in der Wunde, obwohl diese sich am 12 Tage teilweise öffnete und sofort suturiert wurde Die Fieberkurve des Patienten ist jedoch sehr eigenartig (Abbildung 1) Das hohe Fieber hielt 10 Tage an, wonach es etwas sank, aber noch nach 3 Wochen war die Temperatur nicht ganz normal Der Patient hatte keine anderen Verletzungen als die oben beschriebene und eine kleine Splitterwunde am linken Unterschenkel, die ohne wahrnehmbare Zeichen einer Wundentzündung heilte In den Lungen waren zur Zeit des Fiebers keine Symptomen von Pneumonie oder Pleuritis festzustellen Der Patient bekam nichtsdestoweniger reichlich Sulfonamidpräparate (M & B, Sulfathiazol), aber diese hatten keinen Einfluss auf das Fieber Leider konnte unter den obwaltenden Verhältnissen die Diastasemenge des Harnes nicht untersucht werden 23 Tage nach der Operation wurde der Patient als Konvaleszent in ein Militärkrankenhaus evakuiert, wo auf dem daselbst aufgenommenen Röntgenbild in den Lungen nichts Pathologisches konstatiert wurde Es bestand kein Fieber mehr, und der Diastasewert des Harnes war normal



*Fall 8* Soldat N N Bekam bei den Sportwettkämpfen eines Truppenteils, als er gerade einen Hochsprung ausfuhrte, einen mit grosser Kraft geworfenen Sportspeer in die linke Flanke, in der der Speer hängen blieb. Das Ereignis fand am 24. 8. 1913 um 16 Uhr 30 statt. Der Patient wurde schnell in das Feldlazarett gebracht, wo er um 18 Uhr 35 eintraf. Diagn. Vuln. spissum penetr. thoraco-abdominale l. sin. Ruptura ventriculi Nr. I. Ruptura permagna lienis. Haemorrhagia intra-abdominalis gravis. Anaemia sec. gravis. Der Patient befand sich in schwerem Kollapszustand. Sofort Operation. Therapie Laparotomia Splenectomia Suturatio rupt. ventriculi (Ausserdem wurde die Eintrittsoffnung der Speerspitze, die am Pleurasinus lag, revidiert und suturiert, doch war die Pleurahöhle nicht eröffnet worden.) Während der Operation hört der Puls nach der Eröffnung der Bauchhöhle auf, fühlbar zu sein. Wegen einer reichlichen Blutung ist eine anatomische Orientierung unmöglich, da sich aber die Milz bei Palpation als gespalten erweist, wird mit der Hand auf den Hilus gedrückt, wobei die Blutung sistiert und der Puls schwach fühlbar wird. An den anderen Organen sind, abgesehen von einem von der Speerspitze verursachten kleinen Riss in der Hinterwand des Magens, keine Läsionen zu entdecken. Von dem Schwanzteil der Bauchspeicheldrüse erhält man zwar keine deutliche Auffassung, denn er ist von hineingeflossenem Blut ganz infiltriert, aber der übrige Teil der Drüse weist weder Rupturen noch Blutungen auf. Nach der Operation ist der Puls deutlich zu fühlen. Nach der anfänglichen Schwäche begann sich der Allgemeinzustand des Patienten schnell zu bessern. Das hohe Fieber dauerte jedoch anfangs fort, obwohl der Operationsschnitt völlig aseptisch heilte. Ich füge hier den wichtigsten Teil der Fieberkurve des Patienten bei (Abbildung 2).

Es wurde nach der Ursache des Fiebers gesucht, aber sie war anfangs nicht zu ermitteln. Die Sulfonamide (Sulfathiazol) waren ohne Wirkung. Die Lungen waren symptomlos. Widal Typhus —, Paratyphus —, Bang —, Weil-Felix —, WaR —, Kahn —, Harn Alb —, Nyl —. Die Wunde heilte ganz p. p. 1. Doch begann am 25. 8. 1913, 32 Tage nach der Operation, eine begrenzte punktförmige Stelle in der Laparotomienarbe (es handelte sich um einen Schnitt in der Mittellinie zwischen dem Nabel und dem Proc. xiphoideus, erweitert durch Durchtrennung von ein paar Rippenknorpeln nach links schräg oben) unmittelbar unterhalb des Proc. xiphoideus rot zu werden, und als die fragliche Stelle mit der Sonde durchstochen wurde, begannen sich mehrere Dutzend Kubikzentimeter etwas schaumigen, dünnen Sekretes zu entleeren, das einen widerlich süsslichen Geruch, gelblichgraue Farbe und alkalische Reaktion hatte. Dieses Sekret war steril. Da ich sofort vermutete, dass die in Rede stehende Fistel von der Bauchspeicheldrüse ausgegangen sei, schickte ich den Harn des Patienten an mehreren aufeinanderfolgenden Tagen zur Untersuchung in das nächste Militärkrankenhaus. Der Harn langte dort nach etwa zwei Stunden an und wurde unmittelbar untersucht. Die Diastasezahl war in jeder Probe erhöht. Der höchste Wert war 256. Die Rona-Michaelssche Probe, die bei alten Pankreatitiden feinmerkender ist, konnte nicht ausgeführt

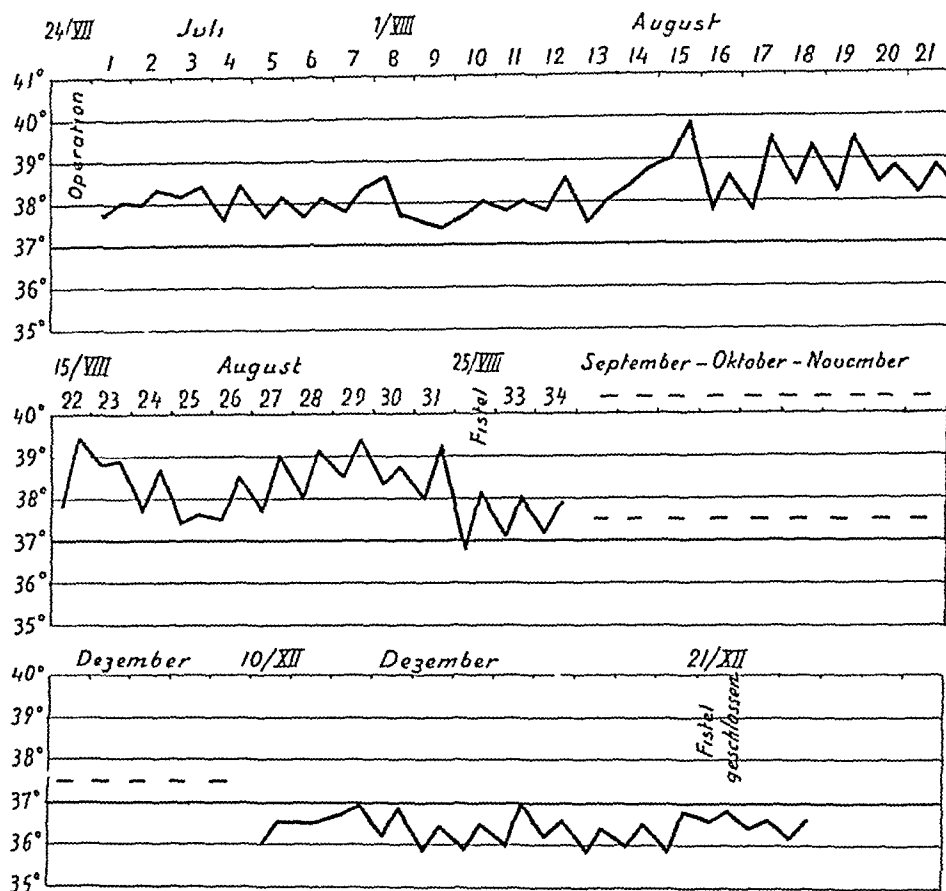


Abbildung 2

werden Ebenso hatte ich keine Möglichkeit, Fistelsekret aus dem entlegenen Feldlazarett zur physiologisch-chemischen Untersuchung einzusenden Das Sekret einer solchen traumatischen Pankreasfistel hatte auf sehr verschiedene Weise analysiert werden können (vgl HOLST) Trotzdem durfte es keinem Zweifel unterliegen, dass es sich um eine Pankreasfistel handelte, die durch eine partielle aseptische Nekrose der Bauchspeicheldrüse hervorgerufen worden war Ich verfolgte den Fall im Feldlazarett weiter Die Behandlung war konservativ Ich versuchte auch die moderne Pankreatitistherapie, vollkommenes Fasten, anzuwenden, konnte aber keine Wirkung feststellen (vgl VUORI), obgleich die Menge der Sekretion schwankte Während die Fistel entstand, nahm die Fieberkurve eine andere Form an Das Fieber war bis dahin vom Typus continua gewesen, begann aber nach dem Aufgehen der Fistel zu »sagen« Der Allgemeinzustand des Patienten war anfänglich bemerkenswert gut und stand zum Fieber im Widerspruch Er besserte sich fortgesetzt auch während des Fiebers, und der Appetit des Patienten war gut Die Sekretion liess wochenlang keinerlei Anzeichen einer Abnahme erkennen Der Patient wurde allmählich während der andauernden Sekretion fieberfrei Anfang Dezember begann sich die Absonderung aus der Fistel zu vermindern Sie wurde schliess-

lich zu einem glasartig klaren, speichelartigen und geruchlosen Schleim. Die Reaktion blieb alkalisch. Endlich am 21. Dezember schloss sich die Fistel ganz, nachdem sie 4 Monate offen gewesen war. Der Patient wurde als Konvaleszent in ein Militärkrankenhaus verlegt. Auf dem hier aufgenommenen Röntgenbild wurde konstatiert, dass die Lungen symptomlos waren. Am 31. Dezember 1943 wurde der Patient in guter Verfassung und wohlgenährt zur Nachkur auf Urlaub entlassen.

Nach der Operation wurde das Blutbild des Patienten einige Male untersucht, und es fanden sich darin folgende Veränderungen:

27. 8. 1943 Hb (Sahl) 48, Er 286, Leukozyt 9000, I 085, Eos 05%, Myelozyt 05%, Neutroph, stabk 5%, Neutroph, polymorphk 685%, Lymphozyt 21%, Monozyt 45%, Plasmazellen 1200.

12. 12. 1943 Hb (Sahl) 63/69, Er 467, Leukozyt 17000, I 75, Eos 05%, Bas 1%, Myelozyt 05%, Neutroph, stabk 2%, Neutroph, polymorphk 63%, Lymphozyt 265%, Monozyt 65%.

31. 12. 1943 Hb (Sahl) 76/84, Er 480, Leukozyt 6900, I 086, Eos 1%, Bas 1%, Neutroph, stabk 1%, Neutroph, polymorphk 64%, Lymphozyt 27%, Monozyt 6%, Plasmazellen 1100.

In der Blutsenkungsgeschwindigkeit trat folgende Veränderung ein:  
29. 10. 1943 35/60, 23. 11. 1943 85/110, 11. 12. 1943 71/102, 18. 12. 1943 30/53 und 27. 12. 1943 10/24.

Die Diastasezahl im Harn war am 30. 12. 1943 32.

Der Patient trat am 2. 2. 1944 wieder bei seiner Truppeneinheit in Dienst. Damals wurde bei der Untersuchung festgestellt, dass sein Allgemeinzustand gut war und dass er gegen früher noch an Gewicht zugenommen hatte. Subjektive Beschwerden waren nicht vorhanden. Die Narbe über dem Nabel war breit, an der Fistel war eine Gewebserosion erfolgt, so dass sich an der Stelle der Narbe in der Rektusscheide eine etwa einen Handteller grosse Bruchpforte befand. Harn Alb —, Nyl —, Wohlgemuth 32. Blutbild Hb (Sahl) 75/83, Er 472, I 099, Eos 2%, Neutroph, stabk 3%, Neutroph, polymorphk 68%, Lymphozyt 21%, Monozyt 6%, SR 4/6.

Unter den vorstehend wiedergegebenen acht Fällen waren die Heilungsaussichten in sechs Fällen im grossen und ganzen die gleichen (die wichtigste therapeutische Massnahme betraf nur die Milz, und eine grosse Infektionsmöglichkeit bestand nicht). Von diesen genasen ohne Fieber und Hyperpyrexie nur drei, einer starb am 5. Tage im Zeichen einer Hyperpyrexie, und zwei hatten hohes und langdauerndes postoperatives Fieber. Diese Fälle vermögen, statistisch betrachtet, die in unserer Überschrift gestellte Frage nicht zu klären. Fall 8 ist jedoch meines Erachtens ausserordentlich aufschlussreich, da bei demselben während des protrahierten Fiebers eine operative Pankreasläsion diagnostiziert wurde.

Um die Häufigkeit der von mir verfolgten Fiebererscheinung durch ein grösseres Material zu erhellen, habe ich die Kranken-

geschichten und Fieberkurven der Splenektomiefälle der I und II Chirurgischen Universitätsklinik in Helsinki aus 20 Jahren 1923—43, durchgesehen<sup>1</sup> Aus dem Material erhält man eine unzweideutige Bestätigung dafür, dass nach Splenektomie eine ungewöhnliche Temperaturerhöhung öfter als nach anderen aseptischen Laparotomien auftritt Aus den folgenden Zahlen Prozentsätze auszurechnen, scheint mir jedoch nicht am Platze, da das Material zu klein ist In den Fällen des Materials sind, auch wenn das Fieber ein ungelöstes Rätsel geblieben ist, keinmal Untersuchungen mit Rücksicht auf traumatische Pankreasnekrose oder Pankreatitis ausgeführt worden Ich habe die Fälle in folgende Gruppen eingeteilt

I Splenektomien, auf die der Tod unmittelbar nach der Operation oder am folgenden Tage gefolgt ist Die Todesursache dieser Fälle kann nicht differenziert werden 13 Fälle

II Splenektomien, bei denen der Tod nach einigen Tagen gefolgt und Hyperpyrexie aufgetreten ist 1 Fall

III Splenektomien, bei denen als Todesursache eine Lungenkomplikation nachgewiesen worden ist 3 Fälle

IV Splenektomien, bei denen der postoperative Verlauf sich ohne ungewöhnlich langes Fieber vollzogen hat, und die Genesung glatt erfolgt ist In einigen Fällen hat auch hier eine einige Tage dauernde Hyperpyrexie bestanden 9 Fälle

V Splenektomien, bei denen ein ungewöhnlich Langdauerndes Fieber (mindestens 10 Tage) aufgetreten ist, dessen Ursache unaufgeklärt geblieben ist, wo aber doch eine Genesung stattgefunden hat 10 Fälle

In den obigen 36 Fällen ist die Splenektomie 8 mal wegen eines Traumas und 28 mal wegen einer Milzkrankung gemacht worden. In beiden Gruppen kamen zu Gruppe V gehörende Fälle vor Auf die Frage, ob Fieber häufiger nach Exstirpation einer pathologischen Milz als nach Beseitigung einer rupturierten normalen Milz auftritt, erubrigt es sich auf Grund eines so kleinen Materials eine Antwort zu suchen

Ich gebe die Fieberkurven zweier charakteristischer Fälle wieder Es wurde in diesen auf jede Weise versucht, die Ursache

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<sup>1</sup> Die Erlaubnis hierzu habe ich von den Vorständen der hier in Rede stehenden Kliniken, Prof T KALIMA und Prof P E A NILANDER, erhalten und gestatte mir, dafür meinen ergebensten Dank auszusprechen

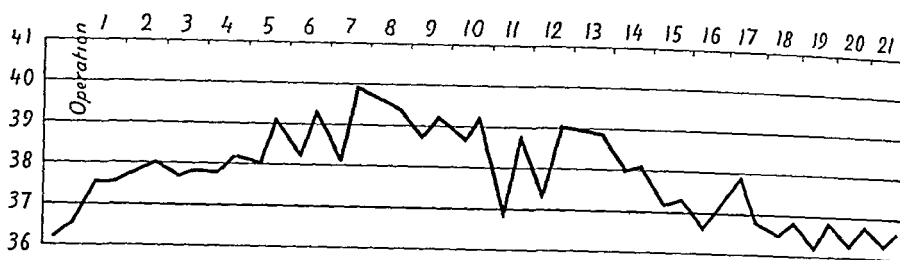


Abbildung 3 Nr 432/1927/I

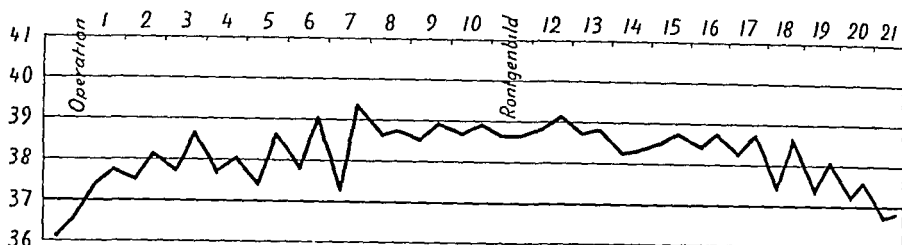


Abbildung 4 Nr 512/1937/I

des Fiebers ausfindig zu machen, aber es haben sich sehr wenig wahrscheinliche Diagnosen ergeben

Kr-G Nr 432 (1937) I Diagn Morbus Banti Therapie Splenectomy Wunde p p 1 geheilt Fieberkurve Abbildung 3 Als Ursache des Fiebers wurde Malaria erklärt Indessen wurden keine Plasmodien gefunden, aber die Diagnose war daraufhin gestellt worden, dass das Fieber gleichzeitig mit der Verabreichung von 0,3 Chinin gesunken war

Kr-G Nr 512 (1937) I Diagn Splenomegalia Therapie Splenectomy Wunde p p 1 geheilt In der Krankengeschichte heisst es, dass links hinten eine »deutliche Pneumonie« vorlag, über Auswurf, Husten und Stiche ist nichts angegeben Dagegen finden sich auf dem am 11 Tage nach der Operation (bei hohem Fieber) aufgenommenen Röntgenbild so wenig Veränderungen, dass der Röntgenolog nicht die Diagnose Pneumonie stellen konnte Fieberkurve Abbildung 4

In der obigen Darstellung habe ich als Ursache des Fiebers nicht die Möglichkeit einer Thrombose der V. lienalis und der V. portae nach Splenektomie erwähnt Diese Komplikation ist aber auch am ehesten zum Bereich der postoperativen Thrombophlebitiden zu rechnen, von denen am Anfang die Rede war Sie dürfte kaum die Ursache des Fiebers bilden, wenn der Patient geheilt wird Diese Komplikation führt meist zum Tode, und ihr Verlauf ist sturmischer

Aus dem Obigen lassen sich folgende Schlüsse ziehen

1) Nach Splenektomie tritt nicht immer ungewöhnlich hohes Fieber auf, sondern der Krankheitsverlauf kann ein ähnlicher sein wie nach jeder anderen aseptischen Operation. Es ist daher schwer, das Fieber als eine von der Milzexstirpation herrührende Störung oder Mangelercheinung im Organismus zu betrachten.

2) Fieber kann sowohl nach Exstirpation einer normalen wie einer pathologischen Milz vorkommen.

3) Ein von mir mitgeteilter Fall von Pankreasfistel, in dem anfanglich (32 Tage vor der Fistelbildung) nur Fieber als Symptom vorlag, spricht für die Auffassung, dass stets, wenn nach Splenektomie ungewöhnlich hohes Fieber auftritt, für das wir keine andere Ursache finden, die Ätiologie in einer bei der Operation erfolgten Pankreasläsion oder einer Hemmung der Blutzirkulation in der Bauchspeicheldrüse (Stauung oder Thrombose in ihren Korpus- und Kaudateilen) zu suchen ist. Die Komplikation ist mithin als ein *traumatisches Pankreasodem*, eine *Pankreasnekrose* oder eine *Pankreatitis* zu betrachten, wobei für diese Krankheiten charakteristische Symptome auch in Blut und Harn auftrieten können.

### Zusammenfassung.

Der Verfasser gibt 8 von ihm behandelte Splenektomiefälle wieder, von denen 7 in einem finnischen Feldlazarett angegangen wurden und welche traumatische Milzrupturen waren, 1 war eine pathologische Milz, die in einem Zivilkrankenhaus Behandlung erhielt. In diesen Fällen war der postoperative Verlauf der Krankheit fieberfrei bei dreien, zwei hatten langandauerndes postoperatives Fieber. Diese 5 Fälle genasen. Einer hatte 5 Tage dauernde Hyperpyrexie, worauf der Exitus folgte, ausser einer Milzruptur hatte er keine anderen Schäden. Zwei starben am Tage nach der Operation, diese hatten auch andere lebensgefährliche Läsionen, so dass ihre Todesursache nicht festgestellt werden kann. Fall 8 ist nach der Ansicht des Verfassers ein aufschlussreiches Beispiel dafür, dass das ungewöhnlich hohe Fieber nach Splenektomie die Folge einer operativen Pankreasläsion ist. Hier entstand eine Pankreasfistel am 32. Tage nach der Operation. Während dieser Zeit hatte der Patient unausgesetzt hohe Febris continua. Auch der Diastasewert im Harn war erhöht. Nach

der Meinung des Verfassers wäre nach jeder Splenektomie eine Diastaseuntersuchung am Blut oder Harn auszuführen

Aus seiner Darstellung zieht der Verfasser folgende Schlüsse

1) Das Fieber nach Splenektomie dürfte nicht auf einer von der Milzeinstülpung herrührenden Störung im Organismus beruhen, da manche Fälle ohne Fieber verlaufen

2) Fieber kann sowohl nach Einstülpung einer normalen als auch einer pathologischen Milz vorkommen

3) Die Ursache eines nach einer Splenektomie entstehenden Fiebers, für das keine andere Ursache zu finden ist, dürfte in einer bei der Operation erfolgten Pankreasläsion zu suchen sein. Die Komplikation ist mithin als ein traumatisches Pankreasödem, eine Pankreasnekrose oder eine Pankreatitis zu betrachten

### Summary.

The author describes eight cases treated by him. Seven of these, all of which were traumatic ruptures of the spleen, were treated in a Finnish Field Hospital. One of these was a pathologic spleen which had been treated in a civil hospital. In three of these cases the postoperative development was without temperature whilst two of them showed protracted postoperative temperatures. All of these five cases recovered. Further, one of the cases had a temperature for five days after which death followed. With the exception of splenic rupture, this patient had no other lesion. Two of the patients died on the day following the operation. These had other fatal lesions as well so that the cause of their death could not be diagnosed. In the author's opinion the eighth case is an illustrative proof of the fact that an unusually high temperature following splenectomy is due to an injury to the pancreas occurring during the operation. This case was further complicated by the appearance, thirty-two days after the operation, of a pancreatic fistula, during which time the patient had a high, continuous temperature (febris continua). There was also an increase in the amount of diastase in the urine. The author is of the opinion that a test for the amount of diastase in the urine or blood should be made after every splenectomy.

The author draws the following conclusions from his presentation of the cases

1) That a temperature following splenectomy should not depend upon the disturbances in the body following the extirpation of the spleen, as shown by many cases which recover without a temperature

2) That a temperature can arise after the extirpation of a normal spleen as well as after the extirpation of a pathologic one

3) The cause for a temperature occurring after a splenectomy, for which it is impossible to find any other explanation, could be found in an injury to the pancreas occurring during the operation. This complication could be caused by traumatic oedema of the pancreas, pancreatic necrosis or pancreatitis

### Résumé.

L'auteur expose 8 cas personnels de splénectomie dont 7 pour ruptures traumatiques de la rate traités dans un lazaret militaire finlandais et 1 pour une affection de la rate traitée dans un hôpital civil. Trois des cas ne présentèrent pas de réaction fébrile après l'opération, deux une réaction fébrile postopératoire prolongée. Ces cinq cas guérissent. Un autre malade décéda après cinq jours d'une hyperpyrexie continue et sans autre symptôme pathologique que la rupture de la rate. Deux malades moururent le lendemain de l'opération mais ils présentaient d'autres lésions mortelles, de telle sorte que la cause de la mort ne put être déterminée. Le huitième cas est, de l'avis de l'auteur, le cas le plus instructif, car la température extrêmement haute suivant la splénectomie était la conséquence d'une lésion opératoire du pancréas. Une fistule pancréatique apparut le 32<sup>e</sup> jour après l'opération. Pendant toute cette période, le malade présenta une température élevée continue (Fig. 2) de même qu'une augmentation de la valeur diastasique de l'urine. L'auteur est d'avis qu'après toute splénectomie, il faudrait procéder à un examen diastasique dans le sang et l'urine.

Voici les conclusions que l'auteur tire de son exposé

1) La fièvre consécutive à une splénectomie ne saurait provenir d'un trouble organique consécutif à la splénectomie car dans maints cas la fièvre est absente.

2) La fièvre se produit aussi bien après l'extirpation d'une rate normale que d'une rate pathologique.

3) Lorsque l'examen ne révèle aucune autre cause de la fièvre consécutive à une splénectomie, il faut chercher cette cause dans une lésion opératoire du pancréas et considérer la complication soit comme un œdème, soit comme une nécrose du pancréas, soit comme une pancréatite

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## Edema in Surgical Patients.

By

LEIF EFSKIND, M D

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### I. Introduction.

With regard to the pathogenesis and treatment of edema there has in the last decades been published a voluminous amount of literature respecting the fluid-electrolytic balance in pathological conditions, both clinical and experimental

It is now known, however, from STARLING's fundamental investigations (1896) that the normal fluid balance is in essential degree dependent on special conditions in the serumprotein and its oncotic pressure The behaviour of the serumprotein and its relation to edema in surgically treated diseases is a field that has been comparatively little investigated And it is only in recent years that the problem of hypoproteinemia has been subjected to systematic examination

As early as in 1832 ANDRAL assumed the tendency to edema to be a result of physical changes in the serum owing to hypoproteinemia Further he believed that such changes might also arise in patients with edema due to hunger

In 1931 WEECH and LING published the results of an investigation respecting the occurrence of edema among large sections of populations which were obliged to live on a diet consisting mainly of vegetables and having a very low content of protein

The examination of their material showed that, in proportion as the serumproteins became reduced, the circulating fluid began to leave the blood vessels, resulting first in latent, afterwards in manifest edema They believed that from their material they could establish the existence of a so-called critical concentration of serumproteins, below which edema arose MOORE and VAN SLYKE had drawn attention to the same matter already in 1930 They fur-

ther showed, however that administration of large quantities of neutral sodium salts, for example, sodium chloride, intensified the hypoproteinemc edema

The most cited investigations dealing with surgical patients to be found in the literature were made by JONES and EATON (1933) They described 26 cases with edema in more or less degree The majority (21) of these patients suffered from diseases of the digestive tract The authors maintained as result of their investigations that hypoproteinemia due to insufficient supply of proteins was probably a determining factor in the pathogenesis of edema The same applied to hypoproteinemia due to great loss of proteins Among the predisposing factors giving rise to this complication they mentioned the postoperative administration of large quantities of fluid and sodium chloride Other predisposing factors were septic infections, copious hemorrhages and retention of bases owing to temporary disturbances of the renal function They believed that a possibility for the occurrence of edema might exist even with seemingly normal preoperative values of the serum proteins They further pointed to the possibility that visceral edema in surgical patients might occasion difficulties of passage in the intestinal tract, for instance, in case of anastomosis operations

Their investigations, however, exhibit a number of defects as regards the technique employed In the first place, it is not clear whether they consistently made determinations of protein-content on the time edema was noted Neither is there given any information as to whether they previously examined the serumprotein content in all these patients, so that they could form an opinion as to the normal value in the patient concerned For it is known that the normal value may show considerable individual variation

In one case no determination of protein seems to have been made at all, and in several other cases they merely made a total determination of protein without fractioning And this is a point of considerable importance in judging about the pathogenesis of edema, seeing that the oncotic pressure of the albumins is four times greater than that of the globulins (GOWAERTS 1924) In case of great displacement towards the large dispersive phase the oncotic pressure may be so low that, in spite of approximately normal values, it may produce a predisposition to edema

Measurement of the total protein-content alone will therefore under pathological conditions not furnish adequate information respecting the degree of oncotic pressure in the serumprotein Neither is it clear from their publication whether the fluid/chloride balance has been sufficiently examined in these patients As they, moreover, have not ascertained the viscosity of the blood and can

have no decided opinion as to whether there has existed hemodilution, and consequently only an artificial hypoproteinemia, the work cannot supply any reliable foundation for estimation of the serum-protein's rôle in the pathogenesis of edema in these patients

## II. Material and methods.

The material investigated comprises altogether 72 patients with different surgical diseases. None of them presented organic lesions (cardiac, renal, vascular) which might predispose to edema. All of them were confined to bed at the time the edema appeared, so that no static factors predisposing to edema can have been present.

The majority of these patients (69) had undergone operations and the edema was as a rule observed during the postoperative period. Only in exceptional cases have they also presented signs of edema before the operation. In most cases examination of the blood in the manner described below was made on admission to hospital, as well as on the first appearance of edema, and as a rule several times after the edema had been detected, sometimes also after it had disappeared. The presence of edema was ascertained in the usual manner, by finger-pressure. Usually it arose first in the ankle region, afterwards and in the more diffused forms also in the sacral region, or in the form of exudate in serious cavities. In one case visceral edema was noted by laparotomy.

The content of serumprotein was measured by Kjeldahl's micromethod. The viscosity of the blood was ascertained by hemoglobin determination, by counting the erythrocytes and ascertaining the hemocrite content. The acid/base conditions were determined from the alkali reserve of the blood and in some cases from the total-base content.

As the edema in most cases had appeared in the period immediately succeeding the operation, it was relatively easy to ascertain the patient's supply and loss of fluid, salts and proteins.

In some laparotomy patients there were, both before and after the operation, taken biopsies from the liver, where the hepatic cells were examined as to content of glycogen, fat and more minute cytological details.

## III. Survey of material.

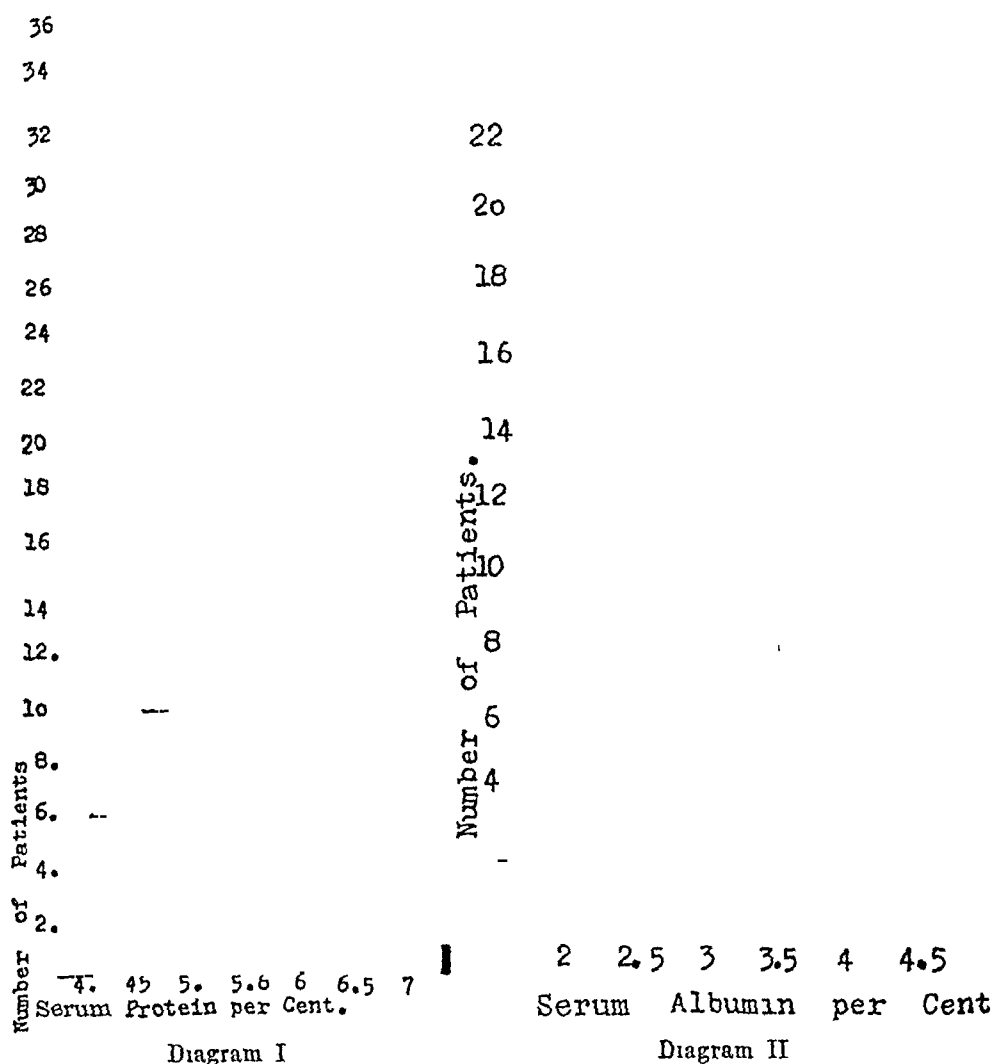
From the diagram I it is seen that the total-protein content in the blood of the patients with edema has in one case been under 4 per cent, in 6 patients between 4 and  $4\frac{1}{2}$  per cent, in 10 between  $4\frac{1}{2}$  and 5 per cent and in 29 cases between 5 and  $5\frac{1}{2}$  per cent.

In the remaining patients, 26 in all, the total-protein value has been over  $5\frac{1}{2}$  per cent, in other words, above the limit usually stated to represent the critical concentration for the occurrence of edema (MOORE and VAN SLYKE). These 26 cases shall here be more closely analysed. Ten of these patients had values below 5.60 per cent, and they do not come into account, since, as we shall see later, the limit for edema in this material lies at about 5.60 per cent total-protein. As regards the pathogenesis of the edema in the remaining 16 patients we must therefore analyse other factors, which, generally regarded, may cause predisposition to edema. It is then natural first to examine the mutual relation between the components of the plasma protein. For, as mentioned above, a displacement in favour of the globulins can result in such a greatly reduced colloid-osmotic pressure that edema may occur in spite of a relatively high total-protein value.

In our material we consistently find a distinct displacement of the proteins towards the large dispersive phase, the globulins. This alteration is usually moderate. From diagram II, which presents the values of albumins in the total material, is seen that these are reduced both absolutely and relatively with following diminution of the albumin-globulin ratio. In only a small fraction, 10 patients, does the albumin concentration lie at or under the value 2.5 per cent, which is declared to be the critical concentration with respect to appearance of edema (MOORE and VAN SLYKE). Only three of these (12, 36, 13) belong to the above-mentioned group with total-protein value above 5.6 per cent.

The changes noted in the serumproteins therefore do not explain the genesis of edema in several (13) of these patients. Neither have we any evidence to show that other primary factors predisposing to edema are present such as increase in the hydrostatic pressure of the arterial capillaries, delayed outflow of tissue fluid through the lymph vessels or serious injury of the blood capillary wall. The variation in concentration of ascorbic acid in blood is here of importance because of the following vitamin of permeability, the citrin. This concentration has consistently been greatly reduced, but not more pronounced than in my material of patients with similar diseases without edema.

Among secondary predisposing factors which may come into consideration in this section of the patient-material we may first of all mention the disproportion in the organism's fluid-salt balance. In several of the patients this balance had already before the operation been deranged on account of the primary lesion, but usually in the direction of dehydration. It is, of course, known that the formation of edema is naturally possible only to the extent



in which water and salt are present. It is likewise known that, even in healthy persons, the balance between intracapillary and extracapillary fluid can be so deranged by administration of large quantities of sodium chloride, that edema is produced. Where there is a tendency to edema beforehand owing to reduced colloid-osmotic pressure smaller doses of salt will, of course, be sufficient to cause the edema to appear.

For several patients of the group with total-protein concentration above 5.6 per cent we find that the supply of salts and liquids has in some cases (4) been considerable. This applies to No. 47 in the group with between 5.6 and 6 per cent total-protein and to Nos. 5, 23 and 27 in the group with more than 6 per cent. The daily supply of liquids for these patients varied between 2,400 and 3,000 g. and the supply of sodium chloride between 14 and 26 g. In some of these cases, however, this overadministration of liquid

and salt took place during a relatively short period, so that the total quantity consumed was not particularly great. The positive fluid-balance has, however, lain considerably above the value which the organism can take up as so-called pre-edemas, 5 to 6 l (JAVAL and WIDAL). Besides, these patients had as a rule been in full fluid balance before the operation, so that the relatively large supply of liquid may nevertheless be deemed to have been a determinant factor in the genesis of the edema. Moreover, all these patients have had distinct hypoproteinemia even though it has not been below the edema limit. Also in view of this fact, the patients may be deemed to have been predisposed to edema. No material change in the blood owing to the copious supply of salt has been observed. In two cases (Nos 27 and 47) there was distinct hypochloremia, while the other patients had normal chloride values. Although the diuresis in some of these cases may have been small and there has not been any extraordinary loss of chloride, yet the copious administration of sodium chloride has made itself felt by an increased content of chloride in the blood.

For the rest of patients (9) within the same group the supply of liquid and salt has, however, not been excessive, and occasionally it might be called scanty. In the group with from 5.6 to 6 per cent total-protein this applies to No 31 and in the group with more than 6 per cent to Nos 24, 29, 34, 45, 46, 50, 54 and 66. Although the fluid-salt content can thus be excluded as a pathogenetic factor for these patients, they all have had edema, sometimes in considerable degree. As they, however, for the same reason are of considerable interest, both theoretical and practical, they shall here be examined in some detail with respect to the primary lesion and to any complications which may be supposed to have created a predisposition to edema.

No 24 had been given salt and fluids in excess. This fact, together with a postoperative peritonitis undoubtedly played a part in the genesis of the edema. His edema afterwards persisted, being intractable to ordinary treatment, probably on account of peritoneal suppuration from a fecal fistula, and at the same time he had severe neuritis in the lower extremities with great muscular atrophy and marked paresis. In addition hereto he had distinct hypoproteinemia, with relatively low albumin fraction. Nos 29, 31 and 34 had disorders of the bile-ducts or of the liver. The two patients with bile-duct lesions (Nos 31 and 34) had distinct hypoproteinemia, but above the edema limit. For No 31 the operative trauma, with chronic icterus and choledochus fistula, may be assumed to have been a contributory cause of the occurrence of edema and for No 34 the peritonitic condition with intense suppuration

No. 29, on the other hand, showed increased total-protein content. He had, however, diffused tumour metastases in the liver, with greatly reduced functioning hepatic parenchyma. It seems as if this may be a predisposing factor for edema, but we shall not here enter further into this problem. No. 45 had suppurative polyserositis with sepsis. She had, however, in spite of normal total-protein value, so low a content of albumin (2.9) that this, together with the severe inflammation and the pericardial affection, may be supposed to have occasioned the edema. No. 46 had, in addition to peritonitis with intestinal fistula, a manifest hypoproteinemia, while the remaining three patients, Nos. 50, 54 and 56, had respectively prostatic adenoma, osteomyelitis in the os sacrum with perforation of the rectum, and strangulation ileus. For the first of these patients a postoperative pneumonia together with considerable hypoproteinemia ought to be a sufficient explanation for the occurrence of edema, which, indeed, disappeared when he recovered from the infection. The second had a diffused suppurative process, anemia and greatly impaired general condition. The last patient had a long-existing strangulation ileus with a copiously discharging fistula in the small intestine.

Biopsies taken from the livers of the patients in this group showed far-reaching changes in the hepatic cells, with glycogen deficit, deposition of fat and derangement of the intracellular metabolic apparatus, a finding which also indicates the importance of the hepatic functions for the fluid-balance in the organism.

A group of the material of special interest in connection with the determination of the edema limit is formed by the cases in which the total-protein concentration lies under 5.6 per cent, that is to say, below the so-called critical concentration, but where edema has either not existed, or else has disappeared. This applies to 6 cases altogether. In three of these (Nos. 6, 8 and 16) the supply of liquids in the postoperative period has been abundant. In the first week after the operation the quantity of liquid consumed was about 2,500 cc per day, the quantity of salt 13 to 16 g daily. The patients were free from edema at concentrations of respectively 5.29, 5.19 and 5.22 per cent total-protein. On examination of the viscosity of the blood it is found that no hemodilution exists, in other words, these patients can hardly be supposed to have presented a passive hypoproteinemia due to copious consumption of liquids. Moreover, their case-histories indicate that the hypoproteinemia is of older date. In No. 6 the edema disappeared, with a distinct increase in the albumin content. There was also an increase in the hemoglobin and hematokrit values.

The remaining four patients in this group (Nos. 1, 15, 44) have

received a very moderate supply of both liquids and salt. There has been no sign of hemoconcentration and the total-protein values found were 5.39, 5.57 and 5.36 per cent, without occurrence of edema. On investigation of the albumin content for this group it was found that in one single case (No. 44) it was below 2.9 per cent. For the others it varied from 3.29 to 4.12 per cent. Thus a couple of them showed relatively high albumin concentrations, which might explain an osmotic pressure higher than the edema limit. One patient (No. 44) showed, in addition to his lower albumin concentration (2.28 per cent), also a considerably impaired general condition, which might be supposed to have predisposed to edema. No. 6 had a urea content of 64 mg per cent in the blood, without, however getting edema. No. 8 had distinct hyperchloremia, 119 m equivalents, and seems to have received abundance of liquids, to judge from the findings in the blood. In spite of all these predisposing factors, this patient had not got edema. No. 53 had considerable anemia after protracted hemorrhage, which might also be supposed to predispose to edema.

A couple of these patients had previously had edema, which had disappeared at the above-mentioned low concentrations of total-protein. In several others we tried to ascertain the concentration of protein when the edema was in the declining phase, or had disappeared.

It is here seen that, while the critical concentration for occurrence of edema lies at about 5.6 per cent in our material, the corresponding concentration in the declining phase of the edema is on the average 6.1 per cent. This latter figure, like the former, is naturally no absolutely fixed value, but is dependent on several factors. One of these is the factor of time and degree, i. e., the length of time the hypoproteinemia and the edema have existed and their degree of intensity. For it is found that, if the edema has lasted long and if there has been protracted hypoproteinemia, then a higher serumprotein value will be required in order to get the edema to disappear than in case of more acute hypoproteinemia.

That a higher concentration is necessary in order to cause the edema to disappear might beforehand be deemed probable, on the assumption that the persistence of the edema in these patients represents a vicious circle and that therefore a higher intravascular osmotic pressure is requisite in order to break that circle. The great majority of these patients had very moderate forms of edema, often only just barely demonstrable ankle edema. The edema in itself could therefore hardly have given rise to any material degree of circulatory disturbance.

It is possible that long-continued hypoproteinemia, besides

have a general deleterious effect on the cells, may also affect the arteriolar and capillary epithelium and thereby alter the permeability thereof. This would naturally in its turn affect the fluid balance and necessitate a correspondingly increased osmotic pressure in order to maintain a normal equilibrium between the circulating blood and the tissue fluid.

#### IV. Discussion.

There are several questions which quite naturally arise in connection with the material here investigated. The most obvious and immediately interesting question is whether the changes observed in the serumproteins can be regarded as the chief causal factors in the pathogenesis of the edema in these surgical patients. In the same connection it naturally suggests itself that we should investigate the practically and theoretically important question as to whether there can be set up a relative and a absolute limit value for the concentration of serumprotein, at which edema constantly appears, in other words, whether there exists a so-called critical concentration for the serumprotein. If the serumprotein must be assigned dominating importance, then the functional conditions in the organs producing it will come under the searchlight, especially with respect to prophylaxis and therapy. The main producer here is, as is generally known, the liver, and the discrimination of normal from pathological liver functions with normal or reduced storage of protein and glycogen in the liver cells might therefore be of considerable importance with respect to the pathogenesis of edema.

There are also known to exist a number of other factors which, generally speaking, are of secondary significance for the pathogenesis of edema. It is then of importance to be able to isolate these factors with a view to preventive and therapeutic measures. In the first line among these auxiliary factors comes the question of the organism's fluid-salt balance and the importance which the administration of liquids and salt has for the occurrence, or disappearance, of the edema. In addition to this purely quantitative consideration there also arises the question whether the mode of administration for salt, and still more for liquids, has any significance.

As more subordinate secondary factors in the pathogenesis of edema it is reasonable to bear in mind the possible importance of the patient's original disorder, his age and general state of health, and finally the question whether the different surgical operations, as well as possible intercurrent infections, may play a rôle in the matter.

As regards the relation of the serumproteins to the genesis

of the edema it was found that 90 per cent of our material had a total-protein concentration in the blood of less than 6 per cent. In these patients there thus existed a distinct hypoproteinemia. Further we find that 80 per cent of the patients had values below 5.6 per cent, which figure has been adopted by us as a relative limit-value for the occurrence of edema. We call it relative because an auxiliary factor often is required in order to produce edema. Of the main factors predisposing to edema, hypoproteinemia is decidedly the one most constantly present in our material, and therefore the greatest importance should be assigned hereto. The fact that hypoproteinemia is not present in 100 per cent of the cases need not necessarily affect its dominant importance, because the pathogenesis of edema is so complicated and the condition is probably due to several unknown factors. That hypoproteinemia is not an absolutely necessary factor is best shown by the fact that edema can be produced experimentally in entirely healthy normal individuals.

The same question presents itself when we are dealing with the possibility of establishing an absolutely certain critical concentration of serum-protein at which edema will invariably appear. Also here the complicated pathogenesis of edema, as well as the fact that the total-protein content need not necessarily constitute an adequate expression for the colloid-osmotic pressure, causes that concentration to be of somewhat fluctuating value. In our material edema constantly appeared, without any demonstrable auxiliary factors being present, when the total-protein content lay at or below 4.5 per cent. But of greater practical clinical importance than absolute edema-limit is the content at which we might expect the danger of edema to be imminent. As already mentioned, this relative edema-limit in our material lies at about 5.6 per cent total-protein.

As regards the significance of the individual protein fractions for the pathogenesis, our material cannot furnish any entirely reliable answer to that question. The variations of the fractions have been relatively small, and only in a moderate number of cases has the concentration of albumin been below the value,  $2\frac{1}{2}$  per cent, which is fixed as the limit for edema. We have, however, cases (Nos. 24, 43 and 69) in which edema appeared when the total-protein concentration was unchanged or increased, while the albumin fraction showed a considerable fall (from 3.85 to 2.71, 3.69 to 2.38 and 3.50 to 2.51 per cent). In three patients (34, 40, 61) the edema disappeared in case of increased albumin fraction, but unaltered or reduced total-protein value. This circumstance, when compared with what has otherwise been observed in the

material, decidedly indicates that a displacement among the fractions in the direction of the globulins represents a fall of sometimes considerable extent in the colloid-osmotic pressure, even in case of approximately normal total-protein value. This displacement, without any appreciable fall in the total values, was often the initial symptom of hypoproteinemia in our surgical material, and it may therefore be taken as a warning to caution in the administration of salt and liquids and as an indication for increased effective supply of proteins.

Accordingly in case of edema-threatening values for the serum-proteins we must note both the total and the fractional values, but yet we have no numerical data respecting their anti-edemic effect — their osmotic pressure. Precisely with a view hereto I have tried to ascertain in the material the values for the colloid-osmotic pressure and have compared these with the figures for protein-content, in order if possible to obtain more adequate indications of the absolute and relative edema-limit than the protein values can afford. Such a conversion of the protein values to the values for osmotic pressure I cannot find to have been previously employed in surgical patients. The procedure cannot, of course, claim to be quite exact. From the diagram III it is seen that for an essential part of the material the figures for osmotic pressure lie between 17 and 20 mm Hg and that over 80 per cent of the patients have values below 20 mm. This critical value is distinctly higher than the normal hydrostatic pressure in the venous capillaries (12 mm Hg). On comparing this with the diagrams showing the protein values we find that the distribution among the separate is, broadly speaking, fairly uniform. This is probably due to the fact that the displacement between the protein fractions has in no case been excessive. But, of course, there are a good many exceptions. Thus we here get an explanation of the fact that several of the patients above-mentioned, with total-protein values above the edema-limit nevertheless get edema, as their colloid-osmotic pressure is found to be low. The same applies to some of the patients who had relatively low protein values, but did not show signs of edema. Altogether it might be said that with osmotic pressure below 18—20 mm Hg strict control must be exercised as to possibly existing secondary factors disposing to edema, as a tendency thereto is then undoubtedly present. Likewise this direct expression for the osmotic pressure ought to be a more reliable basis for estimating the danger of edema than the nominal protein value.

An important consideration when judging about the edema limit and its actual value is the duration of the hypoproteinemia. Here we must clearly distinguish between acute and chronic hypoproteinemia.

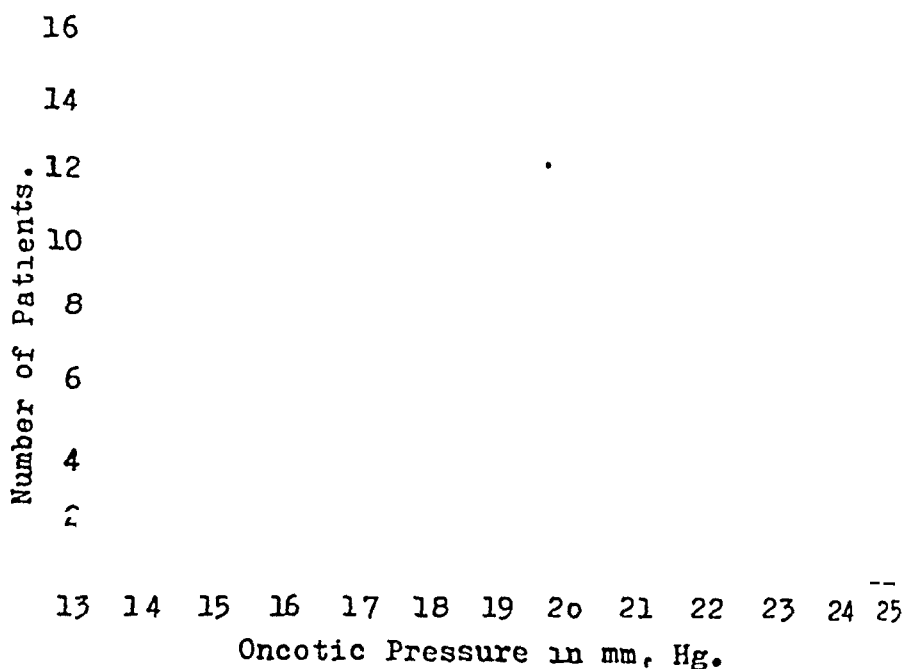


Diagram III

In case of acute transient hypoproteinemia we may find very low protein values, without any edema necessarily occurring. In chronic hypoproteinemia, on the other hand, edema may appear at a far higher protein content.

In two of our cases (Nos. 26 and 39), for instance, where the content of serumproteins remained fairly constant during months, the first sign of edema occurred after the lapse of four months. And this without its being possible to discover any secondary factors predisposing to edema.

In order further to distinguish the different effects of acute and of chronic hypoproteinemia we must examine most closely the causes of these two categories of hypoproteinemia and their effect on the organism. As to the causes of acute hypoproteinemia in the material we find massive hemorrhages, an isolated loss of protein. This hypoproteinemia must have lasted a minimum of 14 days before edema occurs. As regards the cause of the chronic hypoproteinemia it seems to be more complicated. We find on going through the material with a view to the primary lesion that gastric affections stand in the first place, with altogether 22 cases, including 13 carcinomas. Intestinal maladies, including ileus, occurred in 10 cases, liver diseases in 7 cases, pulmonary abscess or empyema likewise in 7 cases, peritonitis in 6, prostatic lesions in 5 and pulmonary tuberculosis in 2 cases.

Thus it is seen that disorders which prevent the reception of

food stand decidedly first in the genesis of chronic hypoproteinemia, while those which entail a considerable loss of protein in the form of secretion are of relatively less frequent occurrence. This is all the more striking because in the surgical department the latter affections are greatly in the majority. Accordingly it is seen that diseases which involve long-continued malnutrition, and consequently also a deficient supply of proteins, predominate greatly over those which have caused a great loss of protein. Here, however, it must be borne in mind that in case of patients with partial inanition it is not only the protein supply that is insufficient, but also the supply of other important nutrients, for example, vitamins, and that this may possibly play a part in the genesis of edema. Meanwhile, no patients with clinical signs of chronic avitaminosis were to be found in our material.

As regards the age and general condition of the patients, it seems to be especially the latter that may be regarded as a factor in the genesis of edema. Meanwhile, poor general condition and hypoproteinemia will often be found to accompany each other, so that we must also reckon with the effects of the last-named factor. Great loss of weight probably increases the predisposition to edema, owing to the reduced tension in the tissues, and the same applies to very advanced age, where changes in the permeability of the blood vessels may, no doubt, also be supposed to arise and where the functions of the organs producing the serumproteins may become impaired. Intercurrent disorders also seem to be of significance, even if they do not directly attack the cardio-vascular system and in that manner predispose to edema. We now know that infections lead to an increased destruction of proteins in the organism, as has been clearly demonstrated in experiments on animals, where also infections produce a predisposition to edema. This increased loss of proteins does not, however, always manifest itself in reduced serumprotein values, as is seen in several cases in our material, where the serumprotein content remained unaltered during the supplementary infection, but where edema nevertheless appeared. Altered capillary permeability may here possibly have an influence. Severe infections, especially peritonitis, are not seldom found in our material as auxiliary factors for production of edema.

With respect to the significance of the different surgical operations, we may naturally expect that protracted operations with great loss of blood will have the effect of reducing the quantity of serumproteins and predispose to the occurrence of edema. Meanwhile it is distinctly seen in our material that protracted operations, even without great loss of blood, and then often operations on vital organs, especially the liver, predispose in a certain de-

gree to postoperative edema. Thus patients, in spite of a nominal increase in the plasmaproteins, got temporary postoperative edema.

On investigation of those patients from whose livers bioptical material was taken at the beginning and conclusion of the operation we find the greatest tendency to postoperative edema in those who show the most distinct changes in the liver cells in the form of reduction or complete loss of glycogen, circulatory disturbances of the hepatic sinusoids and, finally, alterations in the liver cells in the form of disappearance of mitochondria and deposition of fat, and who consequently present the most extensive pathological changes after the operation. When we assume that the liver is the chief place of production for the serumproteins (albumins) and, moreover, has the largest reserve stock of the organism's mobile protein, it seems reasonable to suppose that an increased demand upon the liver and reduced functioning of the liver cells may also lead to mobilisation of the protein reserve and, in turn, to a reduced production of serumproteins. These latter will usually show a decrease after most operations. With normal functioning of the liver and normal reserve stock of proteins, however, restoration to normal values will be merely a matter of some very few days. In case of patients who have been subjected to severe operational traumata this restoration will take a considerably longer time, especially if the general condition has been bad beforehand and if the patient had previously shown signs of chronic hypoproteinemia. In patients suffering from certain liver diseases we also find the albumins to be greatly reduced in proportion to the globulins, which brings about a relatively great fall in the osmotic pressure.

As regards the quantitative investigation of the organism's reserve store of mobile protein, there can, of course, be made no entirely exact determination in clinical material, as we cannot with certainty decide when an organism is fully supplied with mobile protein. Beginning with patients who had previously been living on an abundant diet and who have normal serumprotein values, we have determined the loss of nitrogenous substances in urine and feces until the content of serumprotein began to fall, *i e.*, until the moment when it must be assumed that the organism's reserves of mobile protein are exhausted. In these patients it was easy to ascertain the amount of ingested protein, and the difference between these two quantities should then represent the organism's reserve store.

It is found, however, that in relatively healthy patients who are kept absolutely deprived of protein and receive only water and salt it may not infrequently take a remarkably long time before the serumprotein shows a convincing fall. Thus we have seen

patients who after one month show relatively normal total-protein values. There is here a distinct difference between patients with and patients without lesions in vital organs, such as the liver, so that the production of proteins must be assumed to be reduced, and others. For such patients show a far more rapid and earlier fall in the plasma-protein than those with normal liver functions.

Biopsies from the liver of these patients with liver disease show not only in the apparatus for protein metabolism in the cells (the mitochondria), but also abnormal conditions in their intermediary sugar metabolism. They usually have a greatly reduced glycogen reserve in the liver. It may therefore be said that a liver with abundant supply of glycogen is to some degree a guarantee that also the protein metabolism is proceeding in quite normal extent. When determining the organism's reserve stock of proteins we must take into account that in these patients with relative deprivation of protein the volume of the plasma is reduced, so that the organism can mobilize some protein also therefrom.

As a rule this reserve stock in normal adult persons seems to amount to several hundred grammes. According to investigations made by RAVDIN, WHIPPLE and others this store of protein in the liver plays a prominent rôle for the resistance of the liver cells to various toxic influences. RAVDIN's experiments, however, are not quite adequate, as he has not determined the concentration of the serumproteins in his animals. Yet it is reasonable to suppose that in hypoproteinemia the vehicular function of the serumproteins towards the toxic substances introduced will be impaired and their toxic effect become greater, even though the resistance of the liver cells themselves remains unaltered.

With respect to the importance of the administration of fluid and sodium chloride for the production of edema, this is a problem that has been previously subjected to very intense study. Our material reveals no decisive divergencies from the conceptions generally entertained on this subject. Yet it seems necessary by abnormal protein state to restrict fluid-sodium chloride supply more than is seen from literature. If not extraordinary loss of these substances exists, and the patient beforehand was in fluid-salt equilibrium, an administration of more than 1,200 cc. fluid and 5-6 g. sodium chloride may bring about production of edema. In patients with alterations of the proteins that are direct edema imminent this amount of fluid and sodium chloride must be further reduced. It must be remembered, however, that a restriction under the normal requirement can be injurious, and that it is only a symptomatic treatment. The causal treatment must be directed against the hypoproteinemia.

Table 1

Age	Sex	Diag	Oper	Complic	Edema	Fluid Balance	Sodium Chloride Intake
1 S P 68	Fem	Ca ventric	$^{0}_{1}/_{43}$ Res ven tric et coli	—	$^{27}_{1}/_{+}$ $^{3}_{11}/_{-}$	$^{0}_{1}-^{26}_{1}/_{43}$ Intake 14,600 Loss 7,850	121 gr
2 R I 70	Fem	Ca ventric	$^{23}_{9}/_{42}$ Res ventr subtot	—	$^{23}_{9}/_{+}$	$^{-3}_{9}-^{20}_{9}/_{9}$ Intake 14,600 Loss 7,525	124 gr
3 O M 51	Fem	Ca ventric	$^{11}_{9}/_{42}$ Res ventr	—	$^{16}_{9}/_{+}$ $^{23}_{9}/_{-}$	$^{11}_{9}-^{15}_{9}/_{9}$ Intake 13,100 Loss 7,100	120 gr
4 H S 73	Male	Ca ventric	$^{10}_{5}/_{43}$ Res ventr	—	$^{13}_{5}/_{+}$ $^{17}_{5}/_{-}$	$^{10}_{5}-^{13}_{5}/_{6}$ Intake 4,200 Loss 3,400	25 gr
5 M R 59	Male	Ca ventric	$^{4}_{5}/_{43}$ Res ventr subtot	Peritonit	$^{3}_{6}/_{+}$	$^{24}_{5}-^{2}_{6}/_{6}$ Intake 24,000 Loss 9,000	135 gr
6 H K 64	Fem	Ca ventric	$^{20}_{9}/_{43}$ Res ventr	—	$^{26}_{9}/_{+}$ $^{30}_{9}/_{-}$	$^{20}_{9}-^{23}_{9}/_{9}$ Intake 11,800 Loss 5,000	78 gr
7 K J 42	Male	Ca ventric	$^{6}_{5}/_{43}$ Res ventr et coli	—	$^{11}_{5}/_{+}$	$^{5}_{5}-^{11}_{5}/_{5}$ Intake 19,400 Loss 8,500	138 gr
8 A W 76	Fem	Ca ventric	$^{9}_{9}/_{43}$ Res ventr	—	$^{10}_{9}/_{+}$	$^{1}_{9}-^{9}_{9}/_{9}$ Intake 20,500 Loss 10,700	130 gr
9 R H 72	Fem	Ca coli invaginat	$^{11}_{9}/_{44}$	Peritonitis circumscr	$^{12}_{9}/_{+}$ $^{2}_{9}/_{-}$	$^{6}_{9}-^{22}_{9}/_{9}$ Intake 4,500 Loss 3,100	32 gr
10 D J 68	Fem	Ca ventric inop	$^{8}_{10}/_{42}$ Lap expl	Disrupt $^{21}_{10}$	$^{26}_{10}/_{+}$ $^{5}_{11}/_{-}$	$^{-2}_{10}-^{5}_{10}/_{10}$ Intake 3,100 Loss 1,800	26 gr
11 E R 43	Fem	Ca ven- tric inop	$^{23}_{10}/_{43}$ Gastro- jejuno stomia	Vomitus	$^{22}_{11}/_{+}$ $^{27}_{11}/_{-}$	$^{15}_{11}-^{1}_{11}/_{11}$ Intake 21,600 Loss 11,000	126 gr
12 A A 66	Fem	Ca ven tric inop		Supp osteo- myelitis	$^{23}_{6}/_{43}++$	$^{-7}_{6}-^{28}_{6}/_{6}$ Intake 5,800 Loss 3,500	20 gr
13 J N 72	Male	Ca coli rec	—	—	$^{11}_{10}/_{43}+$	$^{8}_{10}-^{11}_{10}/_{10}$ Intake 7,400 Loss 3,200	54 gr

Date	Tot Prot %	Alb %	Glob %	Nonprot Nitrog Mg% %	Hgb %	Red Blood Cells	Hemato- crit	Clorid
19/1	5 39	3 36	2 03	33	109	6	40	100
27/1	4 42	3 58	0 84	21	104	4 83	36	96
3/11	6 33	3 98	2 35	24	100	4 96	41	103
9/9	6 75	4 28	2 47	34	95	4 70	43	105
9/9	4 89	3 79	1 10	38	87	4 34	33	96
21/8	6 34	3 28	3 06	30	50	3 90	30	102
16/9	5 12	3 13	1 96	26	86	4 20	32	102
23/9	6 69	4 07	2 62	22	81	4 10	33	96
8/4	6 81	3 32	3 49	35	95	4 60	35	102
13/4	5 04	2 62	2 42	28	64	3 13	26	99
17/4	6 02	3 56	2 46	31	90	4 70	24	101
21/5	7 16	4 88	2 28	38	87	5 57	34	93
3/6	6 00	3 06	2 94	48	91	4 52	40	94
11/6	6 82	3 41	2 91	41	109	5 60	34	106
20/9	5 95	4 10	1 85	27	86	3 98	35	107
26/9	4 69	3 00	1 68	31	65	3 43	30	93
30/9	5 29	3 75	1 54	64	82	4 06	34	99
26/4	6 66	4 29	2 37	30	80	4 80	39	100
1/5	5 59	4 28	1 31	26	77	4 40	39	97
8/9	5 19	3 29	1 90	22	92	4 64	28	119
10/9	4 86	3 57	1 29	31	87	4 30	30	103
12/9	5 14	3 08	2 06	28	70	3 80	29	94
2/9	6 70	3 50	3 20	34	68	3 26	31	93
11/9	7 41	3 73	3 68	20	70—82	3 60		96
6/10	5 11	2 65	2 46	42		4 00		91
5/11	7 63	4 21	3 42	42		4 80	42	91
8/10	5 99	3 78	2 21	22	120	5 90	38	97
6/11	5 89	4 13	1 76	23	95			
7/11	5 52	3 31	2 21	27	95	4 70	30	86
7/11	6 46	4 16	2 30	18	90	4 40	31	86
9/6	6 70	3 40	3 30	33	74	4 00	25	98
9/6	5 75	2 50	3 25	45	74	3 62	28	86
1/10	5 54	3 53	2 01	52	50	2 40	18	91

Age	Sex	Diag	Oper	Complic	Edema	Fluid Balance	Sodium Chloride Intake
14 M K 73	Fem	Ca coli	<sup>12</sup> / <sub>7</sub> 43 Ileotrans- versost	—	<sup>16</sup> / <sub>8</sub> ++	<sup>10</sup> / <sub>8</sub> — <sup>16</sup> / <sub>8</sub> Intake 7,700 Loss 5,800	38 gr
15 M L 60	Fem	Ca coli perf	<sup>13</sup> / <sub>9</sub> 43 Coecosto- mia	Peritonit circumscr	<sup>27</sup> / <sub>10</sub> — <sup>9</sup> / <sub>11</sub> ++	<sup>4</sup> / <sub>11</sub> — <sup>8</sup> / <sub>11</sub> Intake 5,800 Loss 4,700	38 gr
16 P G 76	Male	Ileus Ca coli et perit	<sup>17</sup> / <sub>1</sub> 44 Coecosto- mia	—	<sup>2</sup> / <sub>1</sub> +	<sup>17</sup> / <sub>1</sub> — <sup>21</sup> / <sub>1</sub> Intake 11,000 Loss 5,300	78 gr
17 L J 78	Fem	Ca recti inop	<sup>14</sup> / <sub>1</sub> 44 Coecosto- mia	—	<sup>17</sup> / <sub>1</sub> +	<sup>14</sup> / <sub>1</sub> — <sup>16</sup> / <sub>1</sub> Intake 6,800 Loss 1,300	55 gr
18 L K 85	Fem	Ulcus perf	<sup>4</sup> / <sub>4</sub> 43 Sutura	—	<sup>8</sup> / <sub>4</sub> + <sup>12</sup> / <sub>4</sub> —	<sup>4</sup> / <sub>4</sub> — <sup>7</sup> / <sub>4</sub> Intake 11,500 Loss 4,000	54 gr
19 A B 65	Fem	Ulcus perf	<sup>26</sup> / <sub>4</sub> 43 Sutura	Peritonit diff	<sup>26</sup> / <sub>4</sub> +	<sup>24</sup> / <sub>6</sub> — <sup>26</sup> / <sub>6</sub> Intake 4,900 Loss 2,700	29 gr
20 L Ch 67	Fem	Ulcus perf	<sup>17</sup> / <sub>8</sub> 43 Sutura	—	<sup>19</sup> / <sub>8</sub> + <sup>25</sup> / <sub>8</sub> —	<sup>17</sup> / <sub>8</sub> — <sup>19</sup> / <sub>8</sub> Intake 7,200 Loss 1,200	58 gr
21 A L 65	Fem	Ulcus perf	<sup>13</sup> / <sub>9</sub> 42 Sutura	Abscessus subphren	<sup>19</sup> / <sub>9</sub> +	<sup>13</sup> / <sub>9</sub> — <sup>18</sup> / <sub>9</sub> Intake 14,200 Loss 3,800	107 gr
22 S F	Fem	Ulcus duod	<sup>27</sup> / <sub>5</sub> 42 Gastroent	—	<sup>10</sup> / <sub>6</sub> +	<sup>27</sup> / <sub>5</sub> — <sup>9</sup> / <sub>6</sub> Intake 23,150 Loss 15,600	135 gr
23 K S 50	Fem	Ulcus duod	<sup>15</sup> / <sub>4</sub> 42 Res ventr	Retentio ventric	<sup>20</sup> / <sub>4</sub> + <sup>24</sup> / <sub>4</sub> —	<sup>15</sup> / <sub>4</sub> — <sup>19</sup> / <sub>4</sub> Intake 14,600 Loss 5,000	127 gr
24 F H 43	Male	Ulcus duod	<sup>9</sup> / <sub>11</sub> 43 Res ventric	Peritonit Neurit	<sup>8</sup> / <sub>12</sub> + <sup>17</sup> / <sub>9</sub> 44 —	<sup>29</sup> / <sub>11</sub> — <sup>7</sup> / <sub>12</sub> Intake 20,100 Loss 15,900	100 gr
25 I N 24	Male	Ileus strang	<sup>25</sup> / <sub>4</sub> 42 Lap Liberatio	—	<sup>3</sup> / <sub>5</sub> + (slight)	<sup>25</sup> / <sub>4</sub> — <sup>2</sup> / <sub>5</sub> Intake 12,900 Loss 7,800	91 gr Loss 52 gr
26 I I 70	Male	Ileus strang	<sup>18</sup> / <sub>5</sub> 42 <sup>17</sup> / <sub>9</sub> 42 Lap Re- sect ilei Ileostomia	Fistula intest ten	<sup>20</sup> / <sub>9</sub> +	<sup>15</sup> / <sub>9</sub> — <sup>19</sup> / <sub>9</sub> Intake 12,000 Loss 4,000	85 gr

Date	Tot Prot %	Alb %	Glob %	Nonprot Nitrog Mgr %	Hgb %	Red Blood Cells	Hemato crit	Clorid
16/8	4 80	1 85	2 95	29	36	2 30	13	99
8/10	5 57	3 87	1 70	33	56	3 82	21	
10/11	5 17	2 33	2 84	41	73	3 88	26	107
19/1	5 22	4 12	1 10	47	96	4 64	46	96
22/1	5 36	2 81	2 55	34	82	4 14	41	108
14/1	6 77	4 51	2 26	36 4	115	5 60	44	97
15/1	5 73	3 68	2 05	32	86	4 60	37	102
17/1	4 98	2 88	2 10	20	92	5 30	38	95
9/4	5 01	3 41	1 60	20	90	5 10	35	94
12/4	5 85	3 85	2 00	30	87	4 11	35	93 4
26/4	4 39	3 38	1 01	47	88	4 68	38	91
10/8	5 24	3 81	1 43	30	96	4 84	40	89
15/8	6 21	4 38	1 83	28	114	5 44	49	94
19/9	5 07	2 90	2 17	30	87	4 40	41	91
9/10	5 76	2 75	3 01	30	94	4 00	38	100
8/5	6 38	4 42	1 96	32	105			102
0/6	5 33	3 02	2 31	26	94	5 10	41	99
6/4	6 85	4 77	1 88	34	85	4 60	35	103
9/4	6 20	4 20	2 10	32	75	4 10	32	105
4/1	6 86	3 99	2 87	21				
7/11	5 74	3 85	1 89	33	107	5 70	40	97
3/12	6 07	2 71	3 36	37	94	4 72	35	89
44	4 19	2 21	1 98		103	5 18	48	83
1/1	6 35	2 60	3 75	20	123	6 09	47	96
7/9	6 31	2 77	3 54	26	93	4 74	42	93
42	5 21	3 66	1 35	39	92	4 90	38	109
1/6	5 54	2 99	2 55	82	86	4 30	44	100
7/9	5 23	2 88	2 35	34	95	5	45	88

Age	Sex	Disease	Operation	Complication	Edema	Fluid Balance	Sodium Chloride Intake
27 J A 73	Female	Heus	$\frac{27}{10}$ 12 Resect ilei Ileo-stomia	Intestine test ten	$\frac{2}{11}$ -	$\frac{1}{10}$ — $\frac{2}{11}$ Intake 8,400 Loss 1,850	79 gr
28 M L 79	Female	Hern ingu	$\frac{1}{4}$ 44 Operat radical		$\frac{1}{6}$ -	$\frac{27}{10}$ — $\frac{2}{11}$ Intake 7,200 Loss 1,900	34 gr
29 I I 46	Male	Cirrhosis	$\frac{1}{4}$ 42 Lap ex explor		$\frac{1}{10}$	$\frac{2}{10}$ — $\frac{2}{10}$ 42 Intake 9,800 Loss 5,800	32 gr
30 R K 54	Female	Cirrhosis Chol cystitis supp	$\frac{1}{4}$ 43 Cholecyst ectomy stomia		$\frac{1}{10}$	$\frac{1}{10}$ — $\frac{2}{11}$ Intake 13,000 Loss 2,500	35 gr
31 M S 64	Female	Chol docho lithiasis Icterus chron	$\frac{1}{4}$ 42 Chol cyst ect Chol docho stomia	Intestine chol lo h	$\frac{2}{11}$	$\frac{2}{10}$ — $\frac{2}{10}$ Intake 23,400 Loss 13,200	58 gr
32 K L 78	Male	Chol cyst itis			$\frac{11}{11}$ + $\frac{1}{11}$ -	$\frac{11}{11}$ — $\frac{2}{11}$ Intake 12,100 Loss 1,400	80 gr
33 K O 73	Female	Chol cyst it perf	$\frac{1}{4}$ 42 Lap Chole cysto stomia	Peritonit	$\frac{1}{10}$ +	$\frac{11}{11}$ — $\frac{2}{11}$ Intake 22,700 Loss 11,200	125 gr
34 M P 67	Female	Chol cyst it perf	$\frac{1}{4}$ 43 Incision abscess phren	Abscess subphren	$\frac{11}{11}$ - $\frac{2}{11}$ -	$\frac{11}{11}$ — $\frac{2}{11}$ Intake 6,900 Loss 3,400	32 gr
35 J K 70	Female	Cirrhosis	$\frac{1}{4}$ 43 Lap ex explor		$\frac{11}{11}$ +	$\frac{11}{11}$ — $\frac{1}{11}$ Intake 11,400 Loss 3,000	43 gr
36 I H 26	Female	Tbc pulm list bronch	$\frac{1}{4}$ 41 Thoraco plasty	Wound infect	$\frac{2}{11}$ 12 +	$\frac{11}{11}$ — $\frac{1}{11}$ Intake 5,900 Loss 3,200	
37 M T 43	Male	Tbc pulm bilat	$\frac{1}{4}$ 43 Thoraco plasty	Wound infect	$\frac{10}{10}$ + +	$\frac{10}{10}$ — $\frac{11}{11}$ Intake 5,900 Loss 3,700	36 gr
38 G G 67	Male	Abscess pulm	$\frac{1}{4}$ 42 Froicart	Empyema	$\frac{2}{10}$ +	$\frac{1}{10}$ — $\frac{2}{10}$ Intake 6,000 Loss 5,100	

Date	Tot Prot %	Alb %	Glob %	Nonprot Nitrog Mgr %	Hgb %	Red Blood Cells	Hemato- crit	Clorid
3/11	6 01	3 70	2 31	30	94	4 60	34	95
0/9	5 46	4 01	1 45	36	90	4 40	36	112
25/9	4 89	3 57	1 32	44				99
8/7	8 02	3 98	4 04	45	78	3 80	45	102
27/4	7 91	4 38	3 53	27	108	5 02	43	85
5/5	5 29	3 48	1 81	77	92	4 56	29	75
16/9	7 50	4 65	2 85	19	101	4 70	43	96
9/10	5 99	2 94	3 05	23	81	3 70	34	
18/11	5 59	3 43	2 16	12	56	3 62	28	94
11/11	6 47	3 60	2 87	29	73	4 80	28	95
8/9	5 23	2 95	2 28	32	101	4 50	34	98
9/8	6 04	3 16	2 88	32	75	3 80	30	88
3/9	4 62	2 73	1 89	39	83	3 93	39	81
1/11	4 56	2 92	1 64	26	98	4 84	32	97
5/12	6 43	2 93	3 50	36	48	2 30	17	92
44	5 63	4 33	1 30	24	73	3 62	28	102
1/11	6 43	3 49	2 94	35	70	3 66	30	95
1/12	4 81	1 82	2 99	44	68	3 22	29	96
2 41	6 89	3 20	3 67	16	76	4 40	32	90
42	6 80	2 23	4 57	24	57	2 70	28	85
1/9	7 34	4 33	3 01	57	67	3 42	21	102
1/10	5 60	3 74	1 86	22	73	4 33	32	96
10	5 02	3 27	1 75	38	93	4 58	41	93

Age	Sex	Diag	Oper	Complic	Edema	Fluid Balance	Sodium Chloride Intake
39 C J 63	Male	Absc pulm	7/11 43 Resect costae Punctiones	—	11/1 44 +	10/1—21/1 Intake 5,200 Loss 4,150	20 gr.
40 H H 44	Male	Emp pleurae	Punctiones		10/12 43 + 2/1 44 — 14/1 44 + (stat ) 20/1 —	2/1—9/12 Intake 6,100 Loss 4,850	34 gr
41 A T 35	Fem	Emp pleurae	11/1 44 Troicart	—	2/1 ++		
42 A O 57	Male	Emp pleurae	15/1 44 Troicart	—	25/1 + 4/2 —	21/1—22/1 Intake 5,800 Loss 4,300	28 gr
43 A J 63	Fem	Emp pleurae	22/1 44 Troicart	The resi cae	7/2 + 24/2 —	2/2—6/2 Intake 7,000 Loss 4,200	40 gr
44 D J 25	Fem	Ab prov Sepsis	1/8 42 Evacuatio uteri	Absc abd et pulm	7/6 +	2/6—6/6 Intake 11,160 Loss 2,500	30 gr
45 S D 52	Fem	Sepsis Peritonit	11/3 43 App ect Drainage	Emp pleurae Pericardit	2/3 +	2/3—26/3 Intake 6,000 Loss 3,000	32 gr.
46 E H 46	Fem	App ac c perit	21/1 43 App ect Drainage	Abscess f Douglas Fist in test	17/8 +	21/1—16/6 Intake 28,900 Loss 9,000	110 gr
47 G S 27	Fem	Peritonit ac	22/10 43 Incisio pr rectum	Abscess f Douglas	4/11 ++	22/10—4/11 Intake 14,300 Loss 8,000	123 gr
48 E H 56	Male	App ac perf	5/11 43 App ect	Peritonit 14/12	5/1 44 +	21/1—4/1 Intake 11,000 Loss 3,600	60 gr
49 O H 66	Male	Ca pan- creatis	23/1 44 Laparocen tesis	Ascites	2/1 — 27/1 +	18/1—2/1 Intake 6,000 Loss 2,000	35 gr
50 O S 68	Male	Adenoma prostatæ	17/10 43 Prost ect	Pneumonia	1/11 43 +	7/10—21/10 Intake 6,400 Loss 5,250	32 gr
51 H M 68	Fem	Cholecyst itis	29/9 44 Cholecyst- ectomy	—	6/10 +	2/9—6/10 Intake 9,200 Loss 5,600	36 gr

Date	Tot Prot %	Alb %	Glob %	Nonprot Nitrog Mgr %	Hgb %	Red Blood Cells	Hemato- crit	Clorid
4/11	7 00	3 81	3 19	41	100	4 80	39	97
9/11	5 10	3 26	1 84	39	85	4 52		96
14/1	5 39	3 23	2 16	20	78	4 00	29	93
16/3	6 22	3 14	3 08	31 6	82	4 55	38	95
5/1	5 55	3 24	2 31	22	84	4 06	29	92
10/12	5 08	2 82	2 26	27	95	4 64	34	101
14/1	5 53	2 92	2 61	26	83	4 07	32	99
0/1	5 34	3 54	1 80	15 4	79	3 66	33	90
15/1	5 12	2 70	2 42	33	78	3 83	34	
4/1	7 07	3 54	3 53	28	90	4 41	37	95
16/1	4 61	2 89	1 72	19	78	4 05	33	103
4/-	6 05	2 79	3 26	26	83	4 40	35	97
3/1	5 70	3 67	2 03	40	100	5 04	37	86
7/2	5 63	2 38	3 25	23	80	3 98	32	93
1/2	5 79	3 48	2 31	33	88	4 47	32	88
/8	5 36	2 88	2 48	31	81	4 00	33	102
7/9	4 43	2 24	2 19	34	54			89
7/3	7 10	2 90	4 20	63	81	3 94	33	104
7/4	6 77	2 70	4 07	157	52	2 54	19	89
/8	6 10	3 64	2 46	32	80	3 80	32	85
/11	5 99	2 73	3 12	22	64	3 34	23	90
12	5 54	2 98	2 55	25	100	5 12	40	94
/1	4 11	2 15	1 96	14	101	4 90	41	103
/1	4 09	2 64	1 45	19	96	4 64	49	81
/1	5 04	2 54	2 50	41	100	4 80	39	79
1	5 64	3 80	1 84	39	86	4 32	34	87
1	4 92	3 22	1 70	39	72	3 80	30	90
10	5 78	3 40	2 38	26 6	66	3 30	24	90
11	5 81	3 33	2 48	50 4	80	4 10	33	100
7	6 31	4 11	2 20	26	88	4 44	36	100
7	5 60	3 40	2 20	28	97	4 71	47	104
10	4 85	2 73	2 12	22	93	4 47	35	91

Age	Sex	Diag	Oper	Complic	Edema	Fluid Balance	Sodium Chloride Intake
52 A A 69	Male	Ca ventric inop	$\frac{3}{10}$ 44 Lap ex- plor	—	$\frac{10}{10}$ + $\frac{16}{10}$ sl +	$\frac{3}{10}$ — $\frac{10}{10}$ Intake 9,900 Loss 6,000	29 gr
53 O S 71	Male	Hæmaturia	$\frac{13}{1}$ 44 Cystosto- mia	— —	$\frac{17}{1}$ + $\frac{12}{1}$ + $\frac{3}{8}$ Sl +	$\frac{12}{1}$ — $\frac{16}{1}$ Intake 7,700 Loss 3,600	31 gr
54 O N 39	Male	Vulnus sclopetar	$\frac{8}{6}$ 43 Colostomia	Ostemyelit oss sacri Perf rect	$\frac{6}{7}$ 43 + + +	$\frac{1}{7}$ 43— $\frac{5}{7}$ 43 Intake 7,500 Loss 7,700	30 gr
55 A P 63	Fem	Ca mam- mae c metastas	$\frac{7}{1}$ 44 Exstirp mammæ etc	Infect	$\frac{27}{1}$ +	$\frac{22}{1}$ — $\frac{26}{1}$ Intake 6,500 Loss 4,100	34 gr
56 A S 70	Fem	Ileus operat	$\frac{23}{1}$ 44 Lap Libe- rat ad- haes		$\frac{2}{2}$ +	$\frac{28}{1}$ 44— $\frac{1}{2}$ 44 Intake 10,300 Loss 4,500	73 gr
57 A A 82	Male	Adenoma prostatæ	$\frac{2}{5}$ 44 Prostatect	Fever, Me- teorismus	$\frac{31}{5}$ +	$\frac{31}{5}$ — $\frac{30}{5}$ Intake 14,100 Loss 8,500	49 gr
58 E J 73	Male	Adenoma prostatæ	$\frac{11}{5}$ 44 Prostatect	$\frac{2}{6}$ Hæmor- rhagia	$\frac{31}{5}$ + $\frac{5}{6}$ + $\frac{10}{6}$ —	$\frac{26}{5}$ — $\frac{30}{5}$ Intake 8,500 Loss 8,200	36 gr
59 G J 49	Male	Abscess subphren	$\frac{8}{6}$ $\frac{1-}{6}$ 44 Incisio Se- ance I II	Empyema pleuræ	$\frac{3}{6}$ + $\frac{5}{6}$ —	$\frac{2}{6}$ — $\frac{2}{6}$ Intake 7,000 Loss 4,250	34 gr
60 A H 37	Male	Ostemyelit columnæ	$\frac{70}{3}$ 44 Incisio	Pyæmia	$\frac{31}{5}$ + $\frac{5}{6}$ —	$\frac{26}{5}$ — $\frac{30}{5}$ Intake 7,400 Loss 4,500	38 gr
61 M M 65	Fem	Cancer ventricul	$\frac{7}{6}$ 44 Resect ventric et coli transv	—	$\frac{12}{6}$ + $\frac{15}{6}$ Sl + $\frac{26}{6}$ —	$\frac{7}{6}$ — $\frac{17}{6}$ Intake 10,400 Loss 4,600	46 gr
62 V L 58	Male	Ca pulm Empyema pl	$\frac{5}{7}$ 44 Troicart	—	$\frac{21}{6}$ + + $\frac{26}{7}$ + +	$\frac{19}{6}$ — $\frac{23}{6}$ Intake 7,200 Loss 6,100	38 gr
63 P B 69	Male	Ca ventric Diabetes mell	$\frac{3}{7}$ 44 Resectio ventric	—	$\frac{10}{7}$ + $\frac{17}{7}$ —	$\frac{3}{8}$ — $\frac{9}{7}$ Intake 9,350 Loss 8,600	40 gr
64 J N 53	Male	Hæmate- mesis permagn	$\frac{31}{10}$ 44 Resectio ventric	—	$\frac{1}{10}$ + $\frac{9}{10}$ —	$\frac{19}{9}$ — Intake 20,000 Loss 16,800	50 gr

## EDEMA IN SURGICAL PATIENTS

443

Date	Tot Prot %	Alb %	Glob %	Nonprot Nitrog Mgr %	Hgb %	Red Blood Cells	Hemato-crit	Clorid
25/9	6 62	3 85						
10/10	5 91	3 43	2 77	34				
16/10	5 91	3 79	2 48	34	85	4 14	38	98
			2 12	32	80	4 20	36	99
17/1	4 62	2 98			90	4 10	30	100
21/1	5 12	2 81	1 64	16				
3/6	5 46	3 09	2 31	21	43	2 42	20	
			2 37	26	56	2 76	22	97
6/7	6 60				68	3 53	23	99
31/7	6 07	3 14	3 46	41				92
28/10	5 48	2 52	3 55	23	53	2 62	20	89
10/12	5 15	3 88	1 59	21	78	4 00	20	75
		2 12	3 03		56	3 00	16	87
27/1	5 01				86	4 32	33	95
		2 71	2 03	25	73	3 66	27	90
5/2	3 90	2 40	1 50	24 5	100	5 28	37	110
5/5	6 24	7 01						
31/5	4 78	3 37	2 23	30	83	4 44	32	95
			1 41	27	74	3 70	33	102
31/5	5 13	2 75	2 38					
7/6	5 96	4 11	1 85	25	94	3 05		
10/6	6 16	4 06	2 10	29	60	2 99	24	98
				26	77	3 95	28	109
3/6	4 73	3 41	1 32	31	96	4 61	47	105
5/6	5 69	3 67	2 02	27	80	3 86	35	100
20/6	5 52	3 23	2 29	25 5	89	5 02	47	93
31/6	5 48	2 91						
5/6	5 76	3 44	2 57	48	64	4 24	32	98
			2 32	49	67	4 52	34	97
12/6	5 34	2 85						
15/6	6 08	3 33	2 49	21	46	3 18		89
26/6	5 76	4 24	2 75	32 5	80	3 96		89
			1 52	11	86	4 16	39	105
4/6	5 14							
5/7	7 25	2 39	2 75					
25/8	6 22	4 02	3 23	32	105	5 24	45	91
		3 54	2 68	29	100	5 00	42	95
23/6	8 8	5 01		22	88	4 44	39	95
10/7	5 56	3 09	2 99					
17/7	5 85	3 66	2 47	35	95	4 96	36	107
			2 19	21	62	3 57	26	102
3/9	5 10	3 16		18	73	3 46	22	100
27/9	4 34	2 24	1 94					
5/10	4 84	2 71	2 10	66	42	1 90	15	102
9/10	4 81	2 63	2 13	34	42	2 34	16	95
			2 18	37	48	2 16	21	103
				28	66	3 38	36	96

Age	Sex	Diag	Oper	Complic	Edema	Fluid Balance	Sodium Chloride Intake
65 M B 59	Fem	Ca recti	$\frac{3}{8}$ 44 Exstirp recti	—	$\frac{7}{8}$ +	$\frac{3}{8}$ — $\frac{6}{8}$ Intake 7,500 Loss 3,500	33 gr
66 B Y 71	Fem	Ileus Strang	$\frac{12}{8}$ 44 Lap Libe- rat Neo- stomia	—	$\frac{30}{8}$ SI $\frac{8}{9}$ —	$\frac{17}{8}$ — $\frac{23}{8}$ Intake 34,000 Loss 22,800	130 gr
67 A M 77	Male	Ca ven- tric	Resectio ventric	—	$\frac{20}{9}$ + $\frac{26}{9}$ —	$\frac{17}{9}$ — $\frac{19}{9}$ Intake 13,500 Loss 8,500	80 gr
68 G P 38	Fem	Pelvieo- peritonit	—	—	$\frac{6}{6}$ 44 +	$\frac{1}{6}$ — $\frac{5}{6}$ Intake 6,800 Loss 4,800	24 gr
69 B M 28	Male	Tbc pulm	$\frac{11}{8}$ and $\frac{27}{9}$ 43 Thoraco- plasty	Wound infect	$\frac{20}{12}$ +	$\frac{15}{12}$ — $\frac{19}{12}$ Intake 6,000 Loss 4,400	35 gr
70 A R 74	Male	Peritonitis circum- script	$\frac{4}{8}$ 44 Incisio	Thrombo phlebitis	$\frac{20}{8}$ 44 +	$\frac{15}{8}$ — $\frac{19}{8}$ Intake 3,700 Loss 2,950	29 gr
71 A H 42	Male	Ca ventr Stenos pylori	$\frac{27}{10}$ 44 Resectio ventric	—	$\frac{27}{10}$ Visc edema $\frac{1}{11}$ + $\frac{6}{11}$ —	$\frac{1}{10}$ — $\frac{31}{10}$ Intake 23,100 Loss 12,800	130 gr
72 J S P	Male	Hern fem incarc	$\frac{26}{10}$ 44 Resect in- test ten	Meteorisme	$\frac{26}{10}$ asc $\frac{1}{11}$ +	$\frac{26}{10}$ — $\frac{31}{10}$ Intake 15,500 Loss 4,700	76 gr

In patients with normal renal function it is often surprising to see what large quantities of sodium chloride are excreted with the urine. The chloride content in the blood has therefore in only very few cases shown an increased value. The same is found to be the case even in patients with relative low diuresis. The chloride content in the blood has therefore little significance for the question of a possible overdosage with chloride of sodium.

To patients with stomach lesions JONES and EATON have given large quantities of liquid, usually over 3,000 cc per day, and more than 15 g of sodium chloride. They have therefore in general cases succeeded in bringing the content of chloride in the blood up to high values, which, as we have seen, occurred in only a few of our patients. Likewise in their material the blood-chloride does not seem to be any reliable criterion for the patients' salt requirements. The same investigators have also in patients with normal general condition and after *slight* operations produced edema by

Date	Tot Prot %	Aln %	Glob %	Nonprot Nitrog Mgr %	Hgb %	Red Blood Cells	Hemato-crit	Clorid
4/8	7 57	5 00	2 17					
7/8	5 50	3 56	1 94	28	102	5 24		104
9/8	5 57	4 84	0 73	26	75	4 06	37	96
				27 6	78	4 14	32	94
20/8	5 79	3 27	2 52					
8/9	6 25	3 83	2 42	34	90	4 62	33	90
30/9	6 34	3 58	2 76	36	88	4 34	25	94
				35	105	5 60	37	101
15/9	6 61	3 80	2 81					
0/9	5 17	3 40	1 77	30 8	92	4 74		
6/9	6 24	3 52	2 72	27	92	4 70	36	96
				26	90	4 81	31	106
26/9	4 95	2 89	2 06				35	98
				36	67	3 80	30	97
22/11	5 64	3 50	2 14					
10/11	5 43	2 51	3 92	22	88	4 70	30	98
				13	86	5 10	24	92
18/8	5 44	3 11	2 33					
29/8	6 52	2 84	3 68	34 6	84	4 18		
4/9	6 32	3 53	2 79	21 8	82	3 90	85	85
				35	84	4 48	28	103
21/10	4 89	3 01	1 88				28	96
27/10	6 03	3 74	2 29	22	84	4 34		
1/11	4 77	3 06	1 71	29	85	4 04	33	99
6/11	6 88	3 78	3 10	30	79	3 96	33	115
				33	85	4 36	30	103
1/11	5 62	2 84	2 78				34	99
6/11	5 32	3 13	2 19	38	110	5 22		
				62	113	5 70	38	99
							44	105

giving sodium chloride in doses of about 20 g per day during a week. This seems to show that such a quantity of salt represents a considerable excess supply and causes a disturbance of the organism's fluid-salt equilibrium.

As regards the mode of administering salt and liquids, it seems as if edema is more easily produced by intravenous than by subcutaneous administration. This is especially the case when the sodium chloride is given in hypertonic solutions. It is known that the molar concentration in blood of normal organism after administration of hypertonic solutions is restored in the course of a very short time, while the normal quantitative ratio between the different dissolved substances in the plasma is not re-established until later, and last of all the normal ratio between serum-volume and cell-volume. This latter depends on the quantity injected and it may take from 1 to 6 hours before equilibrium is attained and the composition of the blood is again fully normal.

It is then obvious that this process of regulation will be greatly impeded when a tendency to edema exists and that the administration of hypertonic solutions may contribute in high degree to derange the fluid-salt balance. In several patients we have observed the paradox combination of hypochloremia and edema. Further administration of chlorides to these have not raised the chloride values in blood, but only effected further fluid retention.

If the patient is dehydrated, a low content of protein in the blood may, however, be a counter-indication against administration of large quantities of liquid and salt. Such patients may not only be predisposed to edema, but they may also have manifest edema, even if the findings in the blood point to hemoconcentration and dehydration. In these patients therefore the serum-protein content must first be restored to a practically normal level in order to avoid the occurrence of extensive edema. Even though in such patients it may be difficult to raise the serum-protein content by transfusions of unconcentrated plasma, yet such transfusions will have a considerable effect on the edema or will act as a preventive against edema. The immediate effect will be increased diuresis. In the next place, it here seems that the liver first covers its protein deficit and possibly stores up protein before the content thereof in the blood is raised, and that normal storage and normal production of protein is of greater importance for the therapy of edema than the numerical results attained as regards the protein content in the plasma.

### Summary.

- 1 Hypoproteinemia is relatively frequent in patients with chronic surgical lesions for the reason that the disorder itself and likewise the operation occasion a fall in the protein content.
- 2 For pathogenetic and therapeutic reasons the hypoproteinemia in such patients should be divided into an acute and a chronic form.
- 3 The acute hypoproteinemia is, as a rule, not attended by danger of edema, even when the protein values are very low. In chronic hypoproteinemia, on the contrary, edema may occur with relatively high content of protein. Operation patients with chronic hypoproteinemia are therefore distinctly predisposed to edema. The critical concentration differs greatly in these two conditions.
- 4 In the prophylaxis and treatment of edema in surgical patients we must, as in case of edema arising in other lesions, take into account both the primary and secondary predisposing factors.
- 5 As primary predisposing factor comes first of all hypoproteinemia, often combined with abnormal distribution of fractions.

6 Isolated decrease in the content of albumins seems to be of minor importance as predisposing factor for edema in ordinary mixed surgical material, since the albumin values only seldom fall below what is mentioned in the literature as critical concentration, namely 2.5 per cent. 7 Of the secondary predisposing factors may in the first place be mentioned the fluid-salt factor. This must be kept closely under observation, both in patients with hypoproteinemia and in those with abnormal distribution of fractions. Other secondary factors are the patient's age and general condition, the operative trauma and possible infections. 8 The functioning of the liver and its mobile store of proteins — two conceptions which may be closely related to each other — seems to be of importance with respect to the normal regulation of the fluid-salt balance. 9 As regards the cause of the hypoproteinemia in surgical patients lack of proteins is a considerably more important factor than increased loss thereof, but reduced production also seems to play an important rôle. 10 The edema-limit, or the critical concentration of serumprotein, cannot of course, be an absolutely fixed value. It ought to be distinguished between an absolute and a relative edema limit. The relative limit, at which the occurrence of edema may be feared, lies at 5.6 per cent total-protein. The absolute limit, below which edema invariably appeared lies at 4.5 per cent. 11 The best information of imminent edema give direct transport of the protein values to oncotic pressure. The relative limit is then 18—20 mm Hg, the absolute limit 15 mm Hg.

### Zusammenfassung.

1 Hypoproteinämie kommt bei Patienten mit chronischen chirurgischen Krankheiten verhältnismässig häufig vor, da die Krankheit an sich sowie auch die Operation ein Sinken des Proteingehalts hervorrufen. 2 Aus pathogenetischen und therapeutischen Gründen sollte bei Hypoproteinämie solcher Kranken eine akute und eine chronische Form unterschieden werden. 3 Die akute Hypoproteinämie ist in der Regel nicht von Odemgefahr begleitet, selbst wenn die Eiweisswerte sehr niedrig sind. Bei chronischer Hypoproteinämie hingegen kann bei verhältnismässig hohem Eiweissgehalt Odem auftreten. Operationsfälle mit chronischer Hypoproteinämie neigen deshalb ausgesprochen zu Odem. Die kritische Konzentration zeigt bei diesen beiden Zuständen grosse Unterschiede. 4 Bei der Vorbeugung und Behandlung von Odem bei chirurgischen Fällen sind, genau so wie bei durch andere Störungen bedingten Odemen, sowohl die primär als auch die sekundär prädisponierenden Faktoren in Betracht zu ziehen.

5 Als primär disponierender Faktor steht in erster Linie die Hypoproteïnämie, oft in Verbindung mit anormaler Verteilung der Fraktionen 6 Isoliertes Sinken des Gehalts an Albuminen scheint als zu Odem disponierender Faktor bei gewöhnlichem, gemischtem chirurgischem Material von geringerer Bedeutung zu sein, da die Albuminwerte nur selten bis unter den im Schrifttum als kritische Konzentration bezeichneten Wert, nämlich 2 5 %, sinken 7 Von den sekundär disponierenden Faktoren sei an erster Stelle der Wasser-Salzfaktor erwähnt Dieser muss sorgfältig beobachtet werden, und zwar sowohl bei Kranken mit Hypoproteïnämie als auch bei solchen mit anormaler Verteilung der Fraktionen Andere sekundäre Faktoren sind Alter und Kraftzustand des Kranken, das operative Trauma und eventuelle Infektionen 8 Die Leberfunktion und das in der Leber labil gespeicherte Eiweiss — zwei Dinge, die eng miteinander zusammenhängen können — scheinen für die normale Regelung der Wasser-Salzbilanz von Bedeutung zu sein 9 Was die Ursache der Hypoproteïnämie bei chirurgischen Fällen anbelangt, so ist Mangel an Eiweiss ein Faktor von viel grosserer Bedeutung als erhöhte Eiweissverluste, doch scheint auch herabgesetzte Produktion eine bedeutende Rolle zu spielen 10 Die Odemgrenze oder die kritische Konzentration von Plasmaprotein stellt natürlich keinen absolut fixierten Wert dar Es ist eine absolute und eine relative Odemgrenze zu unterscheiden Die relative Grenze, wo das Auftreten von Odem zu befürchten sein kann, liegt bei 5 6 % Gesamteiweiss Die absolute Grenze, unterhalb welcher unfehlbar Odem auftrat, ist 4 5 % 11 Die besten Auskünfte über drohendes Odem gibt die direkte Umrechnung der Eiweisswerte in osmotischen Druck Die relative Grenze ist dann 18—20 mm Hg, die absolute 15 mm Hg

### Résumé.

1 L'hypoprotéïnémie est relativement fréquente chez les malades atteints d'affections chirurgicales pour le motif que le trouble morbide lui-même ainsi que l'opération occasionnent une diminution des protéines dans le sang 2 Pour des raisons pathogéniques et thérapeutiques, on devrait distinguer dans l'hypoprotéïnémie, chez ces malades, une forme aiguë et une forme chronique 3 La protéïnémie aiguë ne provoque généralement pas de danger d'œdème, même lorsque les valeurs protéïniques sont très basses Dans l'hypoprotéïnémie chronique au contraire, l'œdème peut se produire malgré un taux assez élevé des protéines C'est pourquoi les opérés atteints d'hypoprotéïnémie chronique sont nettement prédisposés à l'œdème Le chiffre de la concentra-

tion critique diffère grandement dans les deux cas 4 Tant dans la prophylaxie que dans le traitement des cas chirurgicaux il faut, comme lorsque l'œdème se produit dans d'autres affections, prendre en considération les facteurs prédisposants primaires et secondaires 5 Comme facteur prédisposant primaire vient tout d'abord l'hypoprotéinémie, souvent combinée avec une distribution anormale des composants 6 Une diminution isolée du contenu en albumine semble jouer un rôle moins important comme facteur prédisposant à l'œdème dans le matériel mélangé ordinaire de la clinique chirurgicale, puisque les valeurs de l'albumine ne tombent que rarement audessous du chiffre mentionné dans la littérature comme concentration dangereuse, c'est-à-dire, 2.5 % 7 Parmi les facteurs prédisposants secondaires, il faut nommer en premier lieu le facteur sels solubles Il doit faire l'objet d'un contrôle attentif, aussi bien chez les malades affectés d'hypoprotéinémie que chez ceux souffrant d'une distribution anormale des composants protéiques D'autres facteurs secondaires sont l'âge et l'état général du malade, le traumatisme opératoire et les infections possibles sont d'autres facteurs secondaires 8 Le fonctionnement du foie et sa réserve mobile de substances protéiques — deux termes en étroites relations réciproques — semblent avoir de l'importance en ce qui concerne la régulation normale des sels solubles 9 En ce qui concerne la cause de l'hypoprotéinémie dans les cas chirurgicaux, le manque de protéines est un facteur beaucoup plus important que l'élévation des pertes de celles-ci, mais la diminution de la production semble aussi jouer un rôle important 10 La limite de l'œdème ou la concentration dangereuse de protéine plasmatique ne peut naturellement pas être une valeur tout à fait fixe Il faut distinguer entre une limite absolue et une limite relative de l'œdème La limite relative à laquelle on peut craindre l'apparition de l'œdème se trouve à 5.6 % de la somme totale des protéines La limite absolue au-dessous de laquelle l'œdème apparaît invariablement se trouve à 4.5 % 11 Le procédé de choix pour déterminer l'imminence de l'œdème, c'est l'interprétation des valeurs protéiques en pression oncotique La limite relative est alors de 18—20 mm Hg, la limite absolue de 15 mm Hg

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## Treatment of Bilateral Acoustic Tumors. Report of Six Cases Operated on, with a Review of Thirteen Cases from the Literature.

By

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Cases of bilateral acoustic tumors are relatively rare. Until recently they have been regarded as pathological curiosities hardly deserving any surgical consideration, but the treatment of unilateral acoustic tumors has now reached such a degree of perfection that it should be possible to apply more active therapeutic measures also to cases with bilateral lesions.

At the beginning of this century the attempts to remove acoustic tumors operatively had been very discouraging even in the hands of such skilled surgeons as HORSLEY, KRAUSE and v. EISELBERG. First with the introduction of a new method of treatment — CUSHING's *intracapsular enucleation* — did the mortality figures decrease and in 1917 this author was able to report a series of 29 operatively treated cases of which six only had resulted fatally. With further development of the technic still better results were attained which are well illustrated by DAVIDOFF's follow-up study of CUSHING's cases from 1925 — the year in which the electro-surgery-unit was introduced into the field of neurosurgery. Of the 19 cases of acoustic tumors operated on this year only 2 succumbed. Of the survivals 8 died on an average of four years following operation, while the remaining 9 still were alive fourteen years postoperatively. From this study it also was evident that the patients, who enjoyed the longest survival periods were those, in which the neoplasm had been most radically removed.

DANDY however had early realized the inadequacy of intracapsular enucleation in the treatment of acoustic tumors. In his paper of 1925 he stated that following an incomplete removal of the tumor the growth always must recur. In order to avoid recurrences he devised a method which rendered a total removal of the tumor possible and claimed that a radical extirpation ought to be followed by an even lower mortality figure than a procedure which resulted only in a partial removal of the tumor. The method consisted of a thorough intracapsular enucleation followed by a careful dissection and extirpation of the tumor capsule. DANDY had, however not been able to preserve the facial nerve in his first five cases but was of the opinion that with increasing experience this might be possible.

OLIVECRONA in 1931 adopted the *radical extirpation* as a routine method of treatment which since that date has been applied to all cases of acoustic tumors in which it has been considered technically possible to perform, but with the modification that an attempt always was made to preserve the facial nerve. With increasing experience it has been possible to save this nerve in more than 50 per cent of all cases in which the tumor was totally removed.

The figures given below will illustrate the immediate and 5-years results in a series of cases operated on by OLIVECRONA from 1937 to 1939 inclusive, and may serve as a basis for evaluation of the results in this field of surgery.

1	Radical extirp. with preserv. of N VII	27	cases	with	3	deaths
2	Rad. ext. without preserv. of N VII	11	"	"	3	"
3	Subtotal or intracaps. enucleation	13	"	"	2	"
Totals		51	cases	with	8	deaths
		Survivals	46	cases		
		Died later	2	cases		

Both of those who died later were subtotals. The one died 11 months postoperatively without ever having improved. The other improved to full working ability but died  $1\frac{3}{4}$  years postoperatively from a pneumonia.

*Recurrences.* Only one recurrence occurred in the case of a patient operated on in 1937 by an intracapsular enucleation. When reoperated in 1944 the tumor was totally removed without preservation of the facial nerve.

Among the survivals, ten cases were excluded from further study as information with regard to their present condition was not available all except one being foreigners from invaded countries. (Three were

subtotals, three radical extirpations without, and four with preservation of the facial nerve ) The remaining 34 cases were studied with regard to working capacity and function of the facial nerve The results are compiled in the tables I—II

Table I

*Working ability 5 years postoperatively in cases of unilateral acoustic tumors*

Type of operation	Able to work	Partly incapacitated	Compl incapacitated	Totals
1 Radical extirpation with preservation of N VII	9	8	3	20
2 Radical extirpation without preserv of N VII	2	3	3	8
3 Subtotal or intracaps enucleation	2	2	2	6
Totals	13	13	8	34

Table II.

*Function of facial nerve 5 years postoperatively in cases of unilateral acoustic tumors*

I	After radical extst with preserv of the facial nerve	(20 cases)
1	The facial nerve well functioning	10 cases
2	Reduced function of facial nerve	8 »
3	No function, but facial tonus returned after performance of a spinofacial anastomosis	2 »
II	After radical extst without preserv of N VII	(8 cases)
1	After spinofacial anastomosis facial tonus returned	5 cases
2	After spinofacial anastomosis no facial tonus returned	1 case
3	No anastomosis-operation performed	2 cases
III	After subtotal or intracapsular enucleations	(6 cases)
1	Good or reduced function of facial nerve	4 cases
2	Practically no function of facial nerve	2 »

It is evident that a great deal of experience nowadays is available with regard to the treatment of unilateral acoustic tumors, but the reports concerning the applicability of the same therapeutic principles to cases with bilateral lesions have hitherto been scanty About one half of the thirteen cases collected from the literature antedate the period of modern acoustic tumor surgery, facts which render further reports on the subject desirable

### Diagnosis of bilateral acoustic tumors.

The main signs and symptoms which lead to this diagnosis are due to disturbances from the cranial nerves emerging from both sides of the brain stem in the cerebellopontile angles. It will be roentgenologically confirmed by the demonstration of bilateral dilatation of the internal acoustic meatus.

Usually the disease starts with irritative symptoms from the acoustic nerves and the patient complains over a tinnitus first affecting one ear but later also the other. Simultaneously an increasing nerve-deafness develops and the caloric responses will be found to be greatly diminished or completely abolished. The patient will exhibit an irregular spontaneous nystagmus, usually with slower and coarser jerks when the eyes are turned towards the most affected side than when turned to the other (*Bruns' nystagmus*).

An early sign consists of a diminishing or complete loss of the corneal reflexes. The pressure on the roots of the trigeminal nerves may also lead to disturbances of sensation in the face. A facial paralysis on the other hand, is seldom met with, a striking fact with regard to the exposed position of this nerve which becomes extremely stretched and flattened by the tumors.

Gradually the cerebrospinal pathway through the Sylvian aqueduct becomes occluded, resulting in signs of increased intracranial pressure with headaches, projectile vomiting and papilledema. Finally the localized pressure on various nerve tracts and centers in the pons, medulla and cerebellum produce a great variety of neurological disturbances such as vertigo, ataxia, dysphagia, dysarthria, pyramidal symptoms and disturbances of body sensation.

### Frequency.

HENSCHEN (1915) in an extensive review of the literature, including his own cases, found 24 cases of bilateral and 245 of unilateral acoustic tumors, pointing towards a frequency of 1:10.

CUSHING, however, does not consider this figure indicative of the real proportion between the two types with regards to the fact that bilateral tumors probably more often are recorded than the unilateral ones. He believes the real proportion might be something about 1:100.

At the *Serafimer Hospital*, during the period 1922—43, there have been recorded 241 cases of unilateral and six of bilateral acoustic tumors. The proportion in this material consequently is about 1 : 60, a figure somewhat greater than the one assumed by CUSHING.

In three of these cases the lesions were combined with signs of general neurofibromatosis. All cases were operated on.

### Case Histories.

In the following case histories only such data have been included which were of importance for the therapeutic measures, while many details concerning diagnosis, pathology, heredity etc. have been omitted.

*Case 1*<sup>1</sup> K F R. Male, aged 21. 1205/24. *Bilateral acoustic tumors with central and peripheral neurofibromatosis. Two stage operation with intracapsular enucleation of one of the tumors. No improvement. Death one month postoperatively.*

During the last six months before entry this patient had suffered from a progressive ataxia in his legs and by the time of admittance it was so pronounced that he hardly was able to walk. For nine months he had suffered from a progressive loss of hearing especially of the right side, resulting in an almost complete deafness. During the last six months there was also impairment of vision, especially in the right eye. He also had noticed some paresthesias and spasms in his legs and had been unable to work during the last six months.

Physical examination revealed an ordinarily developed young man with a great number of subcutaneous tumors of which the largest attained the size of a fist. Biopsy showed neurofibroma. Visual perception R = 0.2 L = 0.1.

Papilledema with a protrusion of 6—7 diopters. The right ear deaf, in the left he perceived normal speech and sound. Pronounced ataxia in all four extremities. Some muscular atrophy in the right leg, especially in the peroneous muscles.

*Operation, stage I* 12/19/24 (OLIVECRONA) Anchor-incision. Puncture of the right ventricle. The bone over both cerebellar hemispheres was removed, but during this procedure there was such a loss of blood that the blood-pressure dropped to 100—105 mm Hg and it was therefore decided to postpone further measures. A small incision was made in the dura near the foramen magnum to prevent a possible increase of the intracranial pressure. The covering layers were sutured with silk.

The *second stage operation* was performed 10 days later. On opening the dura a considerable pressure cone of the cerebellar tonsils could be

<sup>1</sup> This case has previously been reported by OLIVECRONA and the post-mortem was published by HÖGLUND.

observed The tumor in the right cerebellopontile angle was exposed and, after incision of its caudal pole, evacuated The removed specimen was about as large as a walnut The hemorrhage from the cavity was stopped with adrenaline and Zenkers solution — The other tumor was then to have been explored, but the patient was already so exhausted, that the operation had to be terminated The dural defect was left open and the wound closed in layers

*Course* During the first days following operation the pulse rate was about 120—130 and the temperature rose to 39.6° C The patient was rather apathetic but answered to simple questions and had no difficulty in swallowing He was incontinent of urine and the condition was eventually complicated with an urinary infection and a bronchopneumonia He died one month postoperatively

*Autopsy* revealed a general neurofibromatosis with tumors attached to several cranial and a great many spinal nerves Numerous tumors were also found in connection with the visceral and peripheral nervous system and in the skin An intracranial meningioma and a glomatous tumor in the cord were also disclosed

*Comment* This young man, mentally in a good condition, had suffered a rapid deterioration of hearing and vision In order to, if possible, preserve these functions, operation was performed, in spite of his pronounced general neurofibromatosis and the desperate prognosis There was no improvement and he succumbed to a urinary and pulmonary infection one month postoperatively

*Case 2<sup>1</sup>* A M E Female, aged 44 952/27 *Bilateral acoustic tumors Two stage operation with intracapsular enucleation of both tumors The patient is still alive 17 years postoperatively, is totally deaf and unable to walk but is able to do some work at home*

Ten years prior to admission this woman had noticed a gradually increasing deafness, first in the left, later also in the right ear During the last four years she had been totally deaf and suffered from a continuous vertigo and ataxia in her legs Her speech was becoming more and more slurred

On examination she was found to be alert and cooperative and was well orientated in spite of her total deafness Her visual acuity was reduced to 0.3—0.4 bilaterally, due to marked papilledema Excessive ataxia in all four extremities There was also a slight muscular weakness in the right side of the face

*Operation in two stages* was performed under local anesthesia by Professor OLIVECRONA

On 5/24/27 a bilateral exposure of the posterior cranial fossa was performed and the cisterna magna was opened by two small incisions through the dura The wound was then closed

Seven days later the dura was opened after tapping of the right cerebral ventricle There was a moderate pressure cone The left tumor, about as large as a walnut, was first attacked and an intracapsular

<sup>1</sup> This case has also previously been reported by OLIVECRONA, but a brief history and follow up to the present is given here

enucleation performed with removal of about 5 grams of tissue. The other tumor was then treated similarly with the removal of about 3 grams of tumor-tissue. The capsule only was left on both sides. After complete hemostasis the cavities were treated with Zenkers solution. The dura was left open and the wound closed.

*Course* The patient made an uneventful recovery and was dismissed 2 months postoperatively. There was still a marked ataxia in both legs, but the ataxia in her arms had greatly improved. This patient is still alive 17 years postoperatively and is now 61 years old. She annually sends us a report of her condition. Naturally she is still totally deaf and the persisting ataxia in her legs prevents her from walking, but she has no headache and enjoys a rather good eyesight which enables her to read and even write her own letters. Her handwriting, previously excellent, has during the last two years, however, begun to be somewhat irregular. Whether this is due to her age or to a real ataxia, indicating a late recurrence of the disease, is impossible to say.

*Comment* The operation in this case effected a regression of the ataxia in the upper extremities and a preservation of vision, while the ataxia in the lower extremities and the total deafness of the patient were unaffected. Obviously the operation has saved her life and made it possible for her to return to some active life.

*Case 3* E B Female, aged 22 1923/34. *Bilateral acoustic tumors. Two stage operation with bilateral intracapsular enucleation. Death on the table from excessive hemorrhage.*

A woman, aged 22, ten years prior to admission began to experience a diminution of hearing in her left ear which five years later had progressed to complete deafness. From that date there was an increasing deafness also in the right ear. During the last year she had suffered from attacks of headache and vomiting. The last six months her vision began to fail and her gait became extremely ataxic.

Examination revealed a bilateral papilledema with 3—4 D elevation in the right and 2—3 D in the left eye. Vision R = 5/18, L = 5/9. She was totally deaf and vestibular responses were absent. Marked ataxia in both arms and legs. She showed a tendency to fall backwards when put into a sitting position. Roentgen examination disclosed a bilateral dilatation of the internal auditory meatus.

Operation was performed under avertin-narcosis by Professor OLIVICRONA on 7/24/34. During the bilateral suboccipital craniotomy the patient collapsed and showed a Cheyne-Stoke type of respiration, probably due to some complication in the posterior fossa. A ventricular puncture failed to reduce the intracranial pressure and when a 1 cm-long opening was made in the dura, cerebellar tissue protruded through it with great force. It was therefore considered best not to open the dura further. The bone was however removed down to the foramen magnum together with the lamina of the atlas. The wound was then closed in layers and a blood-transfusion given.

Already two days later the general condition of the patient had im-

proved to such a degree, that the operation could be continued. Neither this time did ventricular puncture produce a satisfactory diminution of the intracranial pressure and the space in the posterior fossa was very limited. An intracapsular enucleation was performed bilaterally but was followed by a very severe loss of blood. The blood-pressure dropped to a very low level and before a transfusion could be given the patient died.

*Comment* In this desperate case operation was performed in order to relieve the patient from her headache, to save her vision and, if possible, restore the motility of her extremities. Unusual technical difficulties in the management of the case led to a disastrous outcome.

*Case 4 E S H O* Male, aged 20 14/39 *Bilateral acoustic tumors with central and peripheral neurofibromatosis and multiple meningiomas. Radical extirpation of the right acoustic tumor without preservation of the facial nerve. No improvement. Death 2 months postoperatively in bronchopneumonia.*

A man, aged 20, had developed signs of medullary compression at the age of 12. A meningioma at the level of C 5—C 6 had then been removed after which the pressure signs nearly altogether subsided. — One year later his gait was beginning to be unsteady. Next year he developed a diplopia and after another two years, at the age of 16, he noticed tinnitus and increasing deafness first in the right, later in the left ear. — He was admitted to this clinic for the first time at the age of 19. As he evidently was suffering from a Morbus Recklinghausen, operation was advised against. — During the following year, however, his condition grew worse with increasing headache and failing vision, his voice was also becoming increasingly hoarse which all rendered a surgical intervention more urgently desirable.

Examination of the skin revealed only one cutaneous tumor in the back of the neck. The mental condition was unimpaired and there was only a slight papilledema. The right ear was completely deaf and hearing in the left reduced to 0.1. The gait was staggering and ataxic.

*Operation* was performed by Professor OLIVECRONA under local anesthesia on 1/16/39. After a bilateral exposure of the cerebellum the right tumor, the size of a walnut, was extirpated in pieces, its tissue being too fragile to permit an ordinary intracapsular enucleation. The space was however so limited that the facial nerve had to be sacrificed. The original plan was to enucleate the other tumor also (intracapsularly) but it had to be given up because of the friability of the tumors. An attempt in this direction probably would have resulted in damage to the left acoustic nerve which was still functioning well. The left tumor was, however, explored and found to have exactly the same appearance as the right one. The dura was left open and the wound closed.

*Course* Following operation the patient never regained health. His headache, ataxia and dizziness persisted and his voice was very hoarse due to a paralysis of the right recurrent nerve. Two months later he succumbed to a bilateral bronchopneumonia.

*Autopsy* A great number of meningeomas and neurinomas were found both within the skull and the spinal canal. The neurinomas were referred to the proximal parts of the spinal and cranial nerves, but were also widely distributed within the sympathetic and parasympathetic nervous system. The vagus nerves contained numerous microscopic as well as grossly visible tumors.

*Comment* When this patient first was seen the prognosis was considered to be so unfavourable that operation was not recommended. When it nevertheless was performed one year later, it was in order to relieve from headache, to preserve hearing and vision and if possible to improve the laryngeal paresis. No improvement was, however, attained. As a matter of fact the paralysis of the right vocal cord probably was not due to a central vagal lesion but rather to the numerous tumors which were infiltrating the peripheral parts of the vagus nerves. The laryngeal paresis, in turn, probably contributed to the bilateral bronchopneumonia which ended the patient's life.

*Case 5* E. G. A. B. Male, aged 22 37/43. *Bilateral acoustic tumors. Radical extirpation of the left tumor without preservation of the facial nerve. Marked improvement with regainment of some working capacity but after two years beginning deterioration, probably due to increasing pressure from the remaining tumor.*

A chemist, aged 22, six to seven years prior to admission developed a leftsided exophthalmus, diplopia and a progressive disturbance of equilibrium. Three years later he began to suffer from headache and simultaneously noticed tinnitus and a progressive loss of hearing, especially in the left ear. His headache, always worse in the mornings, was principally limited to the left occipital region. During the last years before entry his speech was becoming slurred. Mentally he became more melancholic and irritable. He was first treated as a case of disseminated sclerosis at another hospital but when he subsequently developed a papilledema he was transmitted to this neurosurgical clinic.

Examination revealed a bilateral papilledema with 5 diopters elevation. Visual acuity 0.8 bilaterally. There was a slight paresis of the left internal rectus muscle of the eye with diplopia and also a slight paresis of the left facial nerve. The left ear was completely deaf and in the right he was only able to hear whisperings at a distance of 0.2 meters. His speech was very slurred and he had a marked ataxia, especially in the left arm and leg. He was unable to walk without support. Roentgen-examination revealed a bilateral dilatation of the internal acoustic meatus.

*Operation* was performed by Professor OLIVCRONA under local anaesthesia on 1/27/43. The cerebellum was exposed bilaterally. Both tumors were found to be very large, each of them nearly attaining the size of an egg. The left tumor was first excavated. As, during this procedure, there was a very troublesome hemorrhage, and because of the unusual size of the tumor, it was considered impossible to preserve the facial nerve. The capsule of the tumor was therefore detached without regard to this nerve. The weight of the whole specimen was 25 grams.

Because of the great vascularity of the tissue, an attempt to make a subtotal extirpation of the right tumor was considered futile. A radical extirpation was beyond question, as in that case the patient would have lost the remainder of his hearing and probably would have attained a bilateral facial palsy. The wound was therefore closed without suturing the dura.

*Course.* The patient made a slow recovery. The first days following operation he was apathetic and unable to swallow, so that he had to be fed through a nasal tube. His voice was very hoarse and speech nearly unintelligible, but his condition gradually improved. One month postoperatively hearing acuity in the right ear was normal. After another 3 months a spinofacial anastomosis was performed and the following week he was dismissed. He was then completely free from headache and was able to walk without support, the ataxia having markedly improved. Personally he was very satisfied with the operation, though still somewhat annoyed by tinnitus in his left (deaf) ear.

One year later he reported that the improvement of his general condition, especially his ataxia, had continued so that he now was able to do some work. After another six months, however, he announced that tinnitus had returned also in his right ear, but apart from this symptom he was enjoying a good health and doing some laboratory work. — In a recent report, about two years postoperatively, he complains of headache and increasing ataxia and states that his general health is beginning to fail.

*Comment.* In this desperate case operation was undertaken with the purpose of saving the patient's life, preserving his vision and relieving him from ataxia and headache. From this point of view the operation can be considered as a success, although the patient did not regain full working capacity. Two years postoperatively he is obviously suffering from the effects of increasing pressure from the untreated right tumor. We have, however, decided not to attack this one until hearing function is practically lost, as an enucleation certainly will make the patient irretrievably deaf.

*Case 6.* H. V. L. Female, aged 28. Shop-assistant. 179/44. *Bilateral acoustic tumors + Morbus Recklinghausen. Radical extirpation of the left acoustic tumor with preservation of the facial nerve. Improvement with good working capacity regained within three months postoperatively.*

This woman, aged 28, noticed tinnitus and loss of hearing in her left ear 8 years prior to admission. Two years later a number of cutaneous tumors began to develop in various parts of the body. During the last three years she gradually had developed a leftsided facial paralysis and also noticed some weakness in her left thumb, which subsequently spread to the whole arm. For the last six months she suffered from increasing ataxia in both legs.

Examination revealed a mentally well developed woman of ordinary build. There was a choking of 2—3 diopters elevation of both optic discs. The sensibility was greatly diminished in the left superior part

of her face which also showed a contracture of the muscles indicating an old facial paralysis. Furthermore she revealed a disturbance of balance and a marked ataxia in both arms and the left leg. There was a general muscular weakness in the left arm with atrophy of the thenar eminence. The left leg was slightly spastic with a positive Babinski tibialis phenomenon. Hearing was normal in the right ear but diminished to 1/5 in the left. Roentgen-examination disclosed a dilatation of both internal acoustic meati. Several round subcutaneous tumors could be palpated in various parts of the body. The largest attained the size of a walnut and was found in the left supraclavicular fossa obviously in connection with the brachial plexus.

*Operation* under local anesthesia on 2/22/11 by Professor OLIVIERO. After a bilateral exposure of the cerebellum the tumor in the left cerebellopontile angle, found to be somewhat larger than a walnut, was excised and then radically extirpated with preservation of the facial nerve which, however, was somewhat contused during this procedure. A small neurofibroma was then removed also from the root of the trigeminal nerve of the same side. — The following exploration of the other cerebellopontile angle disclosed a small neurofibroma, the size of a pea, situated within the porus. It could easily have been removed, but with regard to the fact that the right acoustic nerve was still functioning well, an extirpation of this tumor was considered contraindicated. The wound was closed with the dura unsutured.

*Course* The patient made an uneventful recovery and left hospital five weeks postoperatively. Three months later she reported that her facial paralysis was receding and she was experiencing only a slight disturbance of balance. One year following operation she was still well and able to perform household duties. She had difficulties to maintain her balance in the dark but otherwise her gait was quite normal.

*Comment* In this case operation was performed in order to prevent further deterioration of equilibrium and coordination. Unfortunately the remaining function of the left acoustic nerve had to be sacrificed with the removal of the tumor, but there is, on the other hand, a fair chance that the facial paralysis gradually will subside, the pressure on this nerve having been completely relieved. The prognosis in this case naturally, is dependent of the rapidity of growth of the remaining tumors in connection with the central and peripheral nervous system.

In reviewing the available literature the author has been able to find only thirteen previously reported cases of operatively treated bilateral acoustic tumors the essentials of which have been summed up in *table III* together with the corresponding data of our own cases.

The ages of the patients in this material range between 14 and 52 years of age. Men and women are equally represented (Information with regard to sex resp. age, is lacking in three cases.) The average age of the men is 22 years and that of the women

Table

Types of operations applicable to cases of bilateral acoustic tumors	Cases
1 Decompression	RAYMOND HEINE HEINE PENTFIELD YOUNG ORMEROD
2 Decompression + unilateral intracaps enucleation	1 OLIVECRONA EKEHORN <sup>1</sup> GARDNER FRAZIER GARDNER TURNER
3 Decompr + Bilat intracapsular enucleation	2 OLIVECRONA 3 OLIVECRONA FUNKENSTEIN (GARRE)
4 Decompr + unilat radical exstirpat with out preservation of the facial nerve	4 OLIVECRONA 5 OLIVECRONA STEWART et al (HORSLEY) LEWIN (HLYMANN) GARDNER TURNER
5 Decompr + unilat radical exstirp with preservation of the facial nerve	6 OLIVECRONA
6 Decompr + unilat intracaps enucl + radical exstirp of the other tumor without preservation of N VII	
7 Decompr + unilat intracaps enucl + radical exstirp of the other tumor with preservation of N VII	ALAJOUANINE et al (PETIT-DUTAILLIS)
8 Decompr + radical exstirpation of both tumors with preservation of one facial nerve	
9 Decompr + radical exstirpation of both tumors with preservation of both facial nerves	

27 years Most patients were under 30, only two women being older with an age of 44 and 52 respectively

The incidence of multiple neurofibromatosis is 3 6 in our own material and 8 13 in the cases from the literature

Generally the case histories were relatively long with onset of symptoms 5—10 years prior to operation In a few cases, however, there had been a more rapid progression with a history of only 1—2 years

One of our patients died during the operation and two others

<sup>1</sup> See Nr 15 in bibliography

<sup>2</sup> This operation actually seems to have been a bilateral enucleation without preservation of either facial nerve

## III.

Sex and age	Duration of Symptoms Years	Neuro-fibromatosis	Result of operation	Lived post-operatively
♀22	2½	—	Death	0
♂20		+	Death	0
21		+	Improved subjectively	1 year
♀21	7	+	Death	0
14	1	+	Death	0
♂21	6	+	No improvement	1 month
		—	No improvement	8 years
♂28	11	—	Death	0
♂28	11	+	Improved subjectively	3 years
♀44	10	—	Some working ability	17 years +
♀22	10	—	Death	0
♀17	5	+	Death	0
♂20	7	+	No improvement	2 months
♂22	6—7	—	Some working ability	1 ½ years +
♂16	2	—	No improvement	11 months
♂21	1	+	Death	0
♀24	1	—	Full working ability (?)	4 years +
♀28	8	+	Good working ability	4 months +
♀52	13	+	Improved subjectively	2 years

survived only 1—2 months, unimproved. The three remaining cases, however, were relieved from most of their annoying subjective symptoms and markedly improved with regards to their working capacity. Nr 2 has survived the bilateral intracapsular enucleation of her tumors with more than 17 years. Her vision is preserved, she is free from headache and is obviously able to enjoy some active life in spite of the unimproved ataxia in her lower extremities, which prevents her from walking.

The result in case nr 6 up to the present, 1 year postoperatively, has been favourable and this patient has been able to return to some active life, but as this is a case of von Recklinghausens disease the general prognosis of course is precarious.

In case nr 5 there has also been a very marked improvement subjectively and a fairly good vision and hearing acuity have been preserved. A moderate ataxia has persisted but the patient has been able to do some laboratory work. The beginning deterioration two years following operation, however, seems to be the prelude of an apprehended disastrous outcome.

Of thirteen cases from the literature seven survived from 1 to 8 years. Three were, however, not improved with regard to their subjective symptoms. One patient improved but died 2½ years postoperatively. Only one (the second case of GARDNER and TURNER) seems to have regained working capacity.

*Indications for operation.* It might seem questionable whether cases with bilateral acoustic tumors should be operatively treated at all. The here presented series indicate that the chance for the patient to survive and improve is about 40—50 %. Under such conditions operative treatment seems to be justified, but naturally these operations should only be performed by surgeons with great experience in acoustic tumor surgery.

It should be stressed that the figures here given with regard to operative mortality etc. refer to a material of greatly advanced cases. All patients except two were desperately ill with life-threatening symptoms of intracranial pressure and all were affected with advanced neurological disturbances. When earlier performed the operations would probably have given better results both with regards to mortality and residual symptoms. In the two cases which were operated on relatively early (Nr 6 in our series and the above mentioned case of GARDNER and TURNER) the treatment resulted in indubitable benefit for the patients.

Some authors hold that signs of general neurofibromatosis constitute an absolute objection to operative treatment of bilateral acoustic tumors. Case nr 6, one of the best in the series, seems to indicate, however, that such an advice not should be followed too dogmatically. Cases which are affected with only a few skin tumors can always be offered an operation. In those cases, on the other hand, which present a great many skin nodules the decision may be more difficult, but I think it is right to offer also these patients the chance of an operation in order to relieve them from most of their distressing symptoms of intracranial pressure. Only such cases should be excluded from operative treatment in which the lesions are widely distributed within the central and peripheral nervous system with severe defects not due to the acoustic tumors.



radical methods of treatment will be necessary in order to ascertain benefit

There are as a matter of fact nine different operative procedures which can be applied to cases with bilateral acoustic tumors ranging from the technically simplest — the suboccipital decompression — to the most arduous method of bilateral radical exstirpation with preservation of both facial nerves, an operation which never seems to have been performed as yet (See table III)

The following general principles may serve as a guidance for the management of these cases

1 In all cases a deliberate bilateral exposure of the cerebellum is performed and the dura should not be sutured when the wound is closed unless both tumors have been radically removed

2 If some hearing function is preserved, the tumor corresponding to the side in which loss of hearing is most advanced should first be attacked and its removal performed as radically as possible, preferably with preservation of the facial nerve. The effect of this measure can then be awaited. The patient will probably not improve completely, but he will certainly be in a better condition than if he was made totally deaf. The other tumor is not attacked until the general condition again begins to deteriorate or loss of hearing is complete. If no marked improvement is attained by the unilateral exstirpation and if the patient's condition is desperate, the other tumor may be exstirpated in a second session without regard to hearing function but with care being taken to avoid a bilateral facial paralysis

3 If the patient is already completely deaf, both tumors should be removed as radically as possible, which can be performed in one or two stages, depending on how the operations are tolerated. If the facial nerve has been preserved during the removal of one tumor, a radical exstirpation may be attempted on the contralateral side, otherwise only an intracapsular enucleation is performed

### Summary.

1 A brief review is given of the advances of acoustic tumor surgery during the present century, illustrated by some figures with regard to operative results in cases with unilateral acoustic tumors treated in this clinic (Tables I — II). It is pointed out that the operative treatment of these lesions now has reached such a

degree of perfection that active therapeutic measures also may be applied to the bilateral types of the disease

2 An account is given of the diagnosis and the frequency of bilateral acoustic tumors and six cases operated on by Professor OLIVECRONA are reported Two of these were improved and able to return to some active duties and in a third case good working capacity was regained

3 The study is continued with a review of thirteen cases from the literature (table III)

4 The indications for operative treatment and certain details with regard to various operative procedures are then discussed on the basis of this material

The author wishes to express his gratitude to Professor OLIVECRONA for the permission to use the case histories for this study.

### **Zusammenfassung.**

1 Eine kurze Übersicht der Entwicklung und gegenwertigen Stellung der chirurgischen Behandlung der Akustikustumoren mit Angabe der Resultate der hiesigen Klinik (Tabelle I—II) Es wird damit bewiesen, dass die Behandlung der einseitigen Tumoren jetzt eine solche Stufe der Vollkommenheit erreicht hat, dass aktive therapeutische Massnahmen auch bei doppelseitigen Fallen dieser Erkrankung zur Anwendung gelangen konnen

2 Die Diagnose und Haufigkeit der doppelseitigen Akustikustumoren werden erortert, und dann werden sechs Falle beschrieben, welche von Professor OLIVECRONA operiert wurden Zwei von diesen wurden gebessert und einigermassen arbeitsfahig, wahrend der dritte eine gute Arbeitsfahigkeit wiedergewonnen hat

3 Danach werden 13 Falle aus der Literatur erwahnt (Tabelle III)

4 Die Operationsindikationen werden auf Grund dieses Materiales diskutiert und gewisse Besonderheiten inbezug auf den verschiedenen operativen Verfahren angegeben

## Résumé.

1 L'auteur donne un court aperçu du traitement chirurgical des tumeurs acoustiques et indique brièvement les résultats obtenus à la clinique. Il démontre que le traitement des tumeurs unilatérales a atteint actuellement un tel degré de perfection que l'emploi des méthodes thérapeutiques actives se justifie aussi dans les cas de tumeur bilatérales.

2 Il discute la fréquence et le diagnostic des tumeurs acoustiques bilatérales et rend compte de 6 cas opérés par le Professeur OLIVECRONA dont deux ont été améliorés et ont pu reprendre partiellement leurs occupations tandis qu'un troisième a retrouvé une capacité de travail satisfaisante.

3 L'exposé est complété par une analyse de 13 cas mentionnés dans la bibliographie (Tableau III).

4 Se basant sur ce matériel, l'auteur discute les indications de l'opération et fournit quelques détails concernant certains procédés chirurgicaux.

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## Sur la prothèse testiculaire après la castration légale.<sup>1</sup>

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La question de l'insertion de prothèses testiculaires a été discutée par occasion, surtout vers la fin du dernier siècle, quand à l'instar du chirurgien norvégien RAMM (1893) on pratiquait la castration double sur des prostatiques dans le but de diminuer les troubles de miction, mais il semble qu'elle n'a pas été considérée par rapport à la castration légale telle que celle-ci se pratique ces dernières années dans plusieurs pays, après avoir été introduite en Danemark par loi du 1er juin 1929, et pourtant il paraît assez indiqué d'essayer à enlever les hésitations de l'homme qui demande à être châtré en lui faisant ainsi comprendre qu'il peut éviter la déformité résultant de l'étrécissement du scrotum vide

L'attention d'un de nous (H W) à cette déformité fut éveillée, il y a vingt ans, par le cas d'un malade qui, bien des ans avant, avait subi la double castration pour la tuberculose, et quand, plus tard, des sujets furent admis à notre service en vue de castration légale, l'idée nous venait d'essayer l'implantation de prothèses

### I. La prothèse en composé de Stent (ou préparation analogue).

A cette époque-là nous ne trouvions cependant rien dans la littérature médicale au sujet d'appareils prothétiques testiculaires,

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<sup>1</sup> Lu (en abrégé) à la séance de la Société Danoise de Chirurgie le 2 décembre 1944

et ce ne fut qu'en 1936, quand HAMILTON BAILY dans son livre «Diseases of the Testicle» recommandait l'emploi du composé de Stent, que nous décidions d'en faire l'essai, et au mois de novembre du même an nous implantions dans les bourses d'un homme de trente-neuf ans deux prothèses de cette matière, un peu plus petites que des testicules normaux. Le résultat immédiat fut en tous points satisfaisant, les prothèses s'enkystaient bien, et le cas fut décrit par SAND, en 1940, dans un exposé de la castration légale publié dans le «Nordisk Medicin» et dans l'hebdomadaire danois le «Ugeskrift for Laeger». Plus tard il fallut pourtant les enlever pour la cause qu'on verra plus loin. Si dans les années suivantes notre service usait de la réserve à employer ce moyen prothétique, c'était parce que le composé de Stent se laissait difficilement stériliser, et ce ne fut qu'en 1941, quand M. KONRAD JOERGENSEN, assistant du service, avait inventé une méthode qui en assurait l'asepsie absolue, que nous décidions d'offrir régulièrement l'implantation de prothèses à toutes les personnes admises pour castration, d'autant plus que SAND s'adressait à nous dans sa qualité de président du Conseil médico-légal et nous y encourageait, inspiré par le résultat de son examen des trois châtrés sur lesquels nous avons déjà pratiqué le procédé. Dans les six mois suivants (11 août 1941—3 février 1942) l'implantation de prothèses fut encore pratiquée dans 11 cas d'opérés de la double castration soit dans notre service soit (par H. W.) dans la Maison danoise de Détention de Psychopathes, ce qui porte le nombre total, jusqu'à présent, à quatorze (dans un de ces cas il s'agissait d'un homme châtré quatre ans avant, qui désirait maintenant qu'on lui implantât des testicules artificiels). Les premières prothèses étaient seulement un peu plus petites qu'un testicule normal, plus tard on en diminuait encore le volume (voir la photographie ci-dessous, Fig 1, d'une prothèse en verre).

Les résultats obtenus avec les prothèses en composé de Stent (14 cas) n'ont pas été satisfaisants. Dans sept cas seulement l'enkystement se faisait facilement et sans gênes, et ces sept opérés ont été très contents de leurs testicules postiches. Le temps d'observation a été de 33 à 39 mois, en autant que nous comptons que les opérés mis en liberté provisionnelle avec lesquels la Maison de Psychopathes est toujours en rapport l'auraient signalé s'il y avait eu quelque chose à remarquer concernant la condition dans la région intéressée par l'opération subie. Les intervalles de

temps entre l'opération et le dernier examen ont été respectivement de 8, 10, 22, 33, 33, 37 et 39 mois

Les résultats dans les sept autres cas se partagent de la manière suivante. Chez un opéré il se développait un hématome post-opératif (une ligature avait glissé et fut trouvée dans la plaie à la terminaison de l'opération, mais le vaisseau, qui ne saignait plus, ne put pas être retrouvé) et il y eut de la suppuration, de sorte qu'il fallut enlever une des prothèses (journal H 523/42), l'autre s'est enkystée de manière satisfaisante (périodes d'observation respectives 34 et 6 mois). Dans deux cas l'opéré a perdu une de ses prothèses, une ulcération s'étant produite, par laquelle elle est passée dehors après douze à quatorze mois, l'autre prothèse restant toujours bien en place (temps d'observation respectivement 50 et 40, et 31 et 10 mois). Quatre opérés ont perdu les deux prothèses. Dans trois de ces cas il paraît qu'il y a eu un trauma précédent, dont on ne peut cependant dire s'il a d'une manière ou autre contribué à ce résultat. L'enlèvement des prothèses fut pratiqué de quatre mois à cinq ans et demi environ après leur insertion. Pour autant qu'on en a des données sûres les choses se sont développées de la façon que les malades ressentirent de temps à autre des douleurs, puis il s'est produit une ulcération, de sorte que dans quelques cas le malade pouvait lui-même faire sortir la prothèse en exerçant de la pression sur ses bourses, après quoi la plaie s'est assez vite fermée. Trois de ces malades ont dû être admis à l'hôpital, où l'on a enlevé une des prothèses ou les deux (journaux, service H, 2352/41, 527/42, 1088/42).

Toutes les prothèses que nous avons vues ont été décolorées, le rouge vif du composé de Stent ayant jusqu'à une profondeur de 3 ou 4 millimètres changé en une coloration grise rougeâtre. Il y avait même une de ces prothèses dont une partie de la surface était nettement iodée, et chez ce malade il y avait pendant un mois environ après son enlèvement une expulsion de petits fragments, malgré qu'après l'opération on n'avait, à palper, rien senti de débris laissés. La plaie s'est ensuite fermée.

Nous allons relater en plus de détail un seul d'entre ces cas — le premier dans lequel nous pratiquons l'implantation de prothèses (journaux 2145/36 et H 526/42). La castration fut pratiquée le 19 novembre 1936, et des prothèses, de volume un peu plus petit que celui d'un testicule normal furent insérées. Le malade a dit plus tard que «pendant tout le temps» il avait de temps à autre des douleurs dans la moitié gauche du scrotum, mais trois ans après l'opération

il y eut un commencement de tuméfaction. En mai 1940 un examen (par SAND) montra la prothèse droite bien enkystée, tandis qu'autour de la gauche il y avait une intumescence de la grosseur d'un oeuf de canard, ressemblant à une hydrocele, qui gênait un peu le malade. On lui en proposa la ponction, mais il refusa tout traitement à moins qu'on lui garantît de ne pas enlever la prothèse, car il avait justement été très satisfait de ces appareils, notamment aussi quand il prenait des bains en compagnie avec d'autres personnes. Les gênes qu'il en éprouvait augmentèrent cependant au cours des deux ans environ qui suivirent, jusqu'au point qu'en février 1942 il devait être admis à l'hôpital en vue de l'enlèvement des deux prothèses, car dernièrement la partie antérieure du côté droit du scrotum, aussi, était devenue douloureuse et un peu tendre.

Des incisions inguinales furent faites sur les deux côtés, et les prothèses avec le tissu environnant et un peu de la peau du scrotum furent enlevées. Du côté droit où les altérations étaient le moins prononcées, la prothèse était enkystée dans un tissu granulaire, qui à l'examen microscopique (par le Dr SOEBORG OHLSEN) fut trouvé le siège d'une intense inflammation chronique, aiguë, avec des cellules géantes isolées. Comme résultat d'une inoculation on obtint des cocci prenant le Gram. Du côté gauche où il y avait, comme nous avons dit, une intumescence assez considérable, on trouva plus facilement un clivage autour du tissu infiltré, et ici il y avait autour de la prothèse une cavité contenant un liquide faiblement rougeâtre et un peu trouble, et dans le paroi du sac des enduits couleur d'ochre. Des drains furent placés sur les deux côtés dans le scrotum. Du côté gauche un hématome s'est développé, qui pendant quelque temps retardait la guérison. On offrit plus tard à l'opéré l'implantation de prothèses en verre, mais l'offre fut déclinée.

Il découlait nettement de ces expériences que le composé de Stent (pas plus que les autres préparations semblables de manufacture allemande, telles que le «Harvard» et le «Helios») n'était un moyen propre à des prothèses testiculaires, mais comme la possession de ces appareils avait néanmoins donné beaucoup de satisfaction aux porteurs, nous cherchions à trouver une matière qui donnerait de meilleurs résultats. D'après la littérature, l'argent s'y prêterait bien, mais dans les circonstances actuelles l'utilisation de ce métal est hors de question.

## II. La prothèse en verre.

Comme nous l'avons déjà dit, nous avons peu à peu diminué le volume des prothèses, et quand nous décidions d'essayer avec des prothèses en verre, l'idée nous est venue d'employer à cet effet la partie renflée des pointes de verre dont on se sert dans la sinu-

site pour aspirer le pus. On enlève simplement la partie qui entre dans la tube, et obtient ainsi un corps de verre tout à fait lisse, à parois épais, et qui pèse 12 grammes environ (Fig 1)

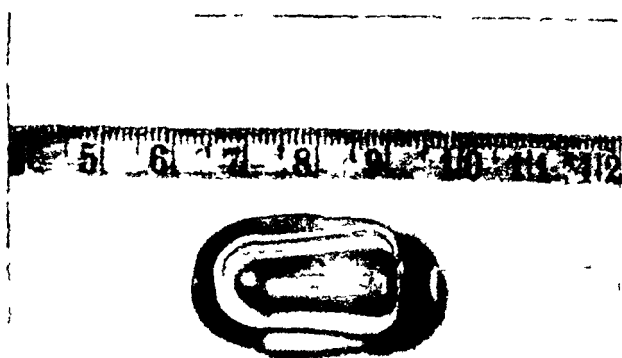


Fig 1

Depuis le 14 avril 1942 jusqu'au 8 août 1944 nous avons implanté de ces prothèses en verre dans les bourses de 30 châtrés, tandis que pendant le même temps il y avait quatre qui ne desuaient pas d'en être pourvus. Chez un malade un petit hématome s'est fait dans l'aîne, chez un autre, qui à la suite de l'anesthésie avait été fort agité, il est survenu une hémorrhagie secondaire de la plaie dans l'aîne 12 jours après l'opération, qui avait été pratiquée dans la Maison de Détention, et il a fallu l'envoyer à l'hôpital pour faire ligaturer une artère saignante, mais aucun de ces deux n'a autrement eu des gênes de leurs prothèses. D'ailleurs, le cas ci-dessus est le seul dans lequel il s'est fait un hématome scrotal, et il n'a pas eu des séquelles permanentes.

Un seul des opérés muni de prothèses en verre n'a pas été revu depuis. Châtré en 1935, il demanda en 1942 qu'on lui implantât des prothèses, et l'opération fut pratiquée sans hospitalisation. Il a été définitivement élargi, et depuis l'opération nous n'avons pas pu le retrouver, il paraît qu'il a été déporté à l'étranger. Tous les autres ont été revus (par SAND) et n'ont pas donné lieu à aucune observation. Huit sont encore dans la Maison de Détention de Psychopathes, les autres, excepté deux (revus respectivement 1 et 6 mois après l'opération), sont toujours sous la surveillance de l'autorité, et sont en communication régulière avec l'institution ou sont visités à domicile. On peut donc compter

à ce qu'ils le rapporteraient s'il y avait quelque chose à remarquer relativement à leurs prothèses, comme cela a du reste été fait par les porteurs de prothèses en composé de Stent chez lesquels celles-ci ont provoqué des complications

Les temps d'observation pour ces vingt opérés sont donc de 13 à 31 mois, et pour les sept sujets opérés en 1944 de 9, 7, 7, 4, 4, 4 et 4 mois respectivement, de quoi il ressort que les prothèses en verre paraissent être bien faites pour cette destination, d'autant qu'elles n'ont pas dans un seul cas provoqué des complications. Un châtré revu quand il les avait portées pendant trente-un mois disait bien qu'elles étaient superflues et inutiles, mais tous les autres ont été unanimes à en exprimer leur satisfaction. Cependant, pour tout ce que les observations jusqu'à présent paraissent le contre-indiquer, il faut admettre la possibilité que des complications puissent encore survenir

### Technique opératoire.

Toutes les opérations furent pratiquées sous anesthésie par l'évipan, et seulement dans un cas le malade eut un accès d'intense agitation post-anesthésique. Une petite incision fut faite dans l'aîne, de manière que la cicatrice serait plus tard masquée par les poils pubiens. Au début nous tordions les vaisseaux divisés, mais ces dernières années nous avons employé des ligatures. Quand le testicule a été détaché du scrotum à l'aide d'un instrument mousse, la cavité est tamponnée avec de la gaze à stryphnone, le tampon étant laissé en place tandis qu'on opère sur l'autre côté, afin d'éviter qu'il se fasse un hématome dans le scrotum. Puis les prothèses sont insérées, tout bas, mais il faut s'assurer qu'elles restent bien au fond, au besoin on les abaissera par traction de dehors.

### Expériences antécédentes avec des prothèses testiculaires.

Il existe dans la littérature médicale de nombreux rapports d'implantations de prothèses testiculaires, dont la plupart ne nous ont cependant été accessibles sauf indirectement, par citation. Il semble que le premier qui ait employé ce procédé est le chirurgien américain HERMAN. L'opération fut faite en 1886, mais ne fut publiée qu'en 1894. WEIR a rapporté en 1895 quelques cas d'implantation de prothèses en celluloid, TUFFIER s'est servi, en 1892, de testicules artificiels en argent, HUMBERT, en 1893, de verre et de stuc. DEMONS, en

1896, remplaçait à trois reprises des testicules par des boules de marbre LOUMLAU, dans la même année, employait des ovoïdes en soie tressée. Tous ses cas sont cités par DE SALLES dans sa thèse de 1896. Dans les premières années de notre siècle on cite des opérations de ce genre par GERSUNY (1900 ou 1901), BURMISTLR (1902) et GUINARD (1903), et en 1904 LEAFER enleva une prothèse en paraffine, infiltrée par une récurrence de tumeur. GERSUNY employait de la vaseline, injectée à plusieurs reprises, 8 grammes chaque fois. Le cas fut brièvement mentionné dans le «Hospitalstidende» en 1901, et dans l'année suivante TRAUTNER publia un cas de «substitution des testicules par la vaseline» dans les circonstances que voici. Un homme de 23 ans s'était mutilé un an avant, dans un accès d'aberration mentale. Maintenant il désirait qu'on l'aiderait à en masquer autant que possible le résultat visible. TRAUTNER alors injecta immédiatement, avec une seringue, 30 grammes de vaseline chaude, stérilisée, dans chaque moitié du scrotum. La vaseline se congela rapidement et fut façonnée à simuler des testicules. Le lendemain l'opéré se sentit un peu mal, mais dix mois plus tard il revint, parce qu'il avait été cité devant le tribunal dans une question de paternité, et pour cette raison il désirait (et obtint) une attestation de son impuissance d'exercer l'acte vénérien avec effet conceptif.

Il paraît qu'en 1917 GLLPI a réuni 16 cas et a publié une mémoire détaillée du sujet, et en 1935 BARNEY a porté le nombre de cas à 20. Les moyens de prothèse employés ont été tour à tour l'ivoire, le marbre, le stuc, le verre, la soie, la paraffine, la vaseline, la vulcanite, la gutta-percha, le celluloid, l'aluminium et l'argent. D'après BARNEY, l'implantation de marbre, de verre, de stuc et de soie aurait rendu nécessaire d'enlever les prothèses, mais il ne cite pas les noms des auteurs qui ont rapporté ces faits. WRIGHT enfin, a rapporté, en 1938, un cas dans lequel du cartilage pris d'un cadavre fut employé comme moyen prothétique. Les matières surtout recommandées sont le celluloid, l'aluminium et l'argent.

Dans la plupart des cas publiés, l'implantation de prothèses fut pratiquée par souci de l'état psychique du malade, parce que la perte des testicules avait amené à sa suite une dépression profonde, et plusieurs auteurs appuient sur l'effet éclatant et continu de la mesure.

Tandis qu'il n'existe ainsi dans la littérature presque rien que des communications casuistiques concernant l'emploi de prothèses testiculaires — et encore, le nombre de cas observé par chacun des auteurs paraît avoir été restreint — nous apportons ici une série d'observations faites par le même opérateur (H. W.) sur un nombre total de 44 opérés, tous ensuite revus et réexaminés par le même examinateur (S.). Comme résultat de nos expériences nous croyons pouvoir recommander l'implantation de prothèses en verre telles que nous venons de les décrire, et l'emploi plus général de ce moyen prothétique testiculaire, surtout dans la castration légale, où c'est hors de doute qu'il aidera dans une

grande mesure à parer à l'effet psychique que l'absence de ses testicules pourra avoir pour le psychopathe. Mais l'implantation de prothèses pourra être utile aussi dans la castration pour d'autres causes, par exemple chez des tuberculeux, ou dans les cas de cryptorchides où les glandes ne peuvent pas être abaissées dans le scrotum, mais doivent être portées au-devant du péritoine ou laissées en ectopie abdominale. Chez les cryptorchides il faudrait pourtant probablement assurer la position de la prothèse au fond du scrotum au moyen d'une suture circulaire (s «de sac à tabac») intérieure, afin qu'elle ne glisse en haut, vers la racine du scrotum.

### Résumé.

Tandis qu'il n'existe dans la littérature médicale que des communications casuistiques sur l'emploi de prothèses testiculaires, — pour lesquelles on s'est servi tour à tour d'une grande variété de substances — il semble que la question n'a pas été considérée par rapport à la castration légale, qui est aujourd'hui pratiquée dans plusieurs pays, après avoir été introduite en Danemark par loi du 1<sup>er</sup> juin 1929.

Après qu'un premier essai, en 1936, d'implantation d'une prothèse en composé de Stent, eut apparemment donné un bon résultat, on employait encore ce moyen prothétique dans 13 cas, mais l'enkystement se fit seulement de manière satisfaisante dans 7 cas, dans 7 autres les prothèses furent expulsées, ou l'on était obligé de les enlever, ou sur une côté ou sur les deux. Depuis, on a employé des prothèses en verre, façonnées des pointes de verre dont on se sert dans la sinusite pour aspirer le pus. On a implanté de ces prothèses dans 30 cas, dont 28 ont été réexaminés, dans 21 de ceux-ci le temps d'observation a été d'un an ou plus. Cet appareil prothétique a été parfaitement toléré par les tissus et a donné beaucoup de satisfaction aux porteurs. La méthode est recommandée, parce qu'elle empêche la déformation résultant de l'étrécissement du scrotum et parce qu'elle aide à diminuer l'hésitation de demander la castration. Elle peut être employée aussi dans la cryptorchidie.

### Summary.

As the information appearing in literature about the use of artificial testes is only casuistic — for which many different kinds of material have been used — it seems that the question has not been taken up in support of legal castration, which is now practiced in many countries, since it has been introduced into Denmark by a law passed in 1929

As a first trial of placing an artificial testis made from Stent's material in 1936 appears to have been successful, they have been used in 13 other cases of which only 7 kept in position whilst the other 7 either got displaced or had to be removed from one or both sides

After this one has used artificial testes made from the glass cones which are used for aspiration in sinusitis. These artificial testes have been used in 30 cases of which 28 have been subjected to postoperative examination — the observation time for 21 cases was over one year. They have not caused any discomfort whatsoever and those concerned have been very satisfied

The method is recommended as it prevents deformity from scrotal shrinkage and also lessens the misgivings when applying for castration. The method can also be used in cryptorchidism

### Zusammenfassung.

Während im Schrifttum nur kasuistische Mitteilungen über Verwendung von Testisprothesen vorliegen — wobei viele verschiedene Arten Material verwendet wurden — scheint die Frage im Anschluss an die legale Kastration nicht aufgenommen worden zu sein, die jetzt, nachdem sie in Danemark durch ein Gesetz vom Jahre 1929 eingeführt wurde, in verschiedenen Ländern Verwendung findet

Nachdem ein erster Versuch mit Einlegung einer Prothese aus Stent'scher Masse im Jahre 1936 anscheinend günstig ausgefallen war, fanden diese Prothesen in weiteren 13 Fällen Verwendung, heilten aber nur bei 7 glatt ein, während bei 7 anderen die Prothesen auf einer oder beiden Seiten ausgestossen wurden oder wieder entfernt werden mussten

Es wurden darauf gläserne Prothesen verwendet, die aus den bei Sinusitis zum Absaugen verwendeten Glasspitzen hergestellt

waren Diese Prothesen wurden bei 30 Fällen eingelegt, von denen 28 nachuntersucht worden sind — bei 21 beträgt die Beobachtungszeit mehr als 1 Jahr Die Prothesen gaben keinerlei Beschwerden, und die betreffenden Personen waren mit ihnen sehr zufrieden

Die Methode wird empfohlen, da die durch Schrumpfung des Hodensackes entstehende Deformität vermieden wird, und die Bedenken gegen das Gesuch um Kastration vermindert werden Auch bei Kryptorchismus kann die Methode Verwendung finden

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P. A N O R S T E D T & S Ö N E R  
S T O C K H O L M

From the Surg Clin I Sabbatsbergs Hosp, Stockholm  
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## Mucous and Salivary Gland Tumours in the Bronchi and Trachea,

formerly generally called bronchial adenomata.

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As a result of the progress made in latter years in bronchoscopy and pulmonary surgery, the solitary tumours in the trachea and the bronchi, that of old have generally been called bronchial adenomata in the literature, have attracted an ever increasing interest

The origin of these tumours, and the question whether they are always benign or sometimes malignant, are matters that are still being discussed. On the basis of the material we are now presenting, we consider that we can classify these tumours, and thereby explain their varying clinical aspects

The cases now reported were treated at the Sabbatsberg Hospital during the years 1931 to 1942, partly in the Surgical clinics I and II, and partly in the department of diseases of the ear, nose and throat

One group of these cases is decidedly benign both as regards pathologic-anatomical and clinical findings. In another smaller group the tumours presented histological aspects indicating a certain malignancy, though no such clinical signs were found. In two cases finally the tumours displayed their malignant character by the occurrence of metastases

## I

## Clinically and Histologically Benign Tumours.

## A

## From the bronchi

*Case 1*

K II Diary no 1622/39 A 25-year old woman

Earlier history of no interest In the autumn of 1937 a hacking cough, fatigue and lassitude In January 1938 an acute hemoptysis Two tablespoonsfuls of liquid were coughed up Admitted into sanatorium on Feb 2, as tuberculosis was suspected Treated there for one month No tubercle bacilli could be demonstrated Patient discharged on Feb 28, free from symptoms Apart from periodical hacking cough well and working in autumn 1938 The quantities of sputum then increased and it was occasionally bloodstained, so the patient was admitted into another sanatorium on April 11, 1939, and was observed there until Aug 15, 1939 At the sanatorium the diagnosis of stenosis of the bronchus of the right upper lobe was finally arrived at, and the patient was sent to the Sabbatsberg Hospital for a closer examination The roentgenogram disclosed changes in the upper lobe both of atelectatic type and of the type observed in an expansively growing tumour

Bronchoscopy showed an almost complete occlusion of the right main bronchus caused by the protrusion of a tumour which grew into the lumen of the main bronchus like a polypus almost completely obstructing it The polypous tumour appeared, however, to be free from the wall of the bronchus of the upper lobe around its orifice The biopsy disclosed a fibromyxoepithelial growth of the type of a mucous- and salivary-gland tumour The degree of malignancy could not be estimated on the basis of the pieces excised

Op Sept 5 Thoracotomy (acc to CRAFOORD) No glands displaying metastases could be found in the hilus, nor could any changes be felt indicating a malignant tumour

As the biopsy showed no signs of malignancy, and both the bronchoscopical and the clinical picture rather indicated a benign tumour, lobectomy was decided upon During the dissection it was found, however, that the tumour grew caudally outside the wall of the bronchus of the upper lobe It was therefore necessary to excise so large a piece of the wall of the main bronchus, that the middle lobe bronchus could not be saved Thus both the upper and the middle lobes were removed The defect resulting in the main bronchus, which was 22—23 mm long, and 4 mm at its widest part, was closed by isolated silk sutures in the wall of the bronchus and a continuous catgut suture between them, none of these perforating the mucous membrane Then the suture-line was covered with mediastinal tissue and pleura

During the resection of the lobes the main bronchus had been compressed with a semi-soft clamp, and when this was removed the suture proved to be air-tight at a spiropulsator pressure of 20 cm of water.

Before the thorax was closed by primary suture, acc to CRAIGORD, the lower lobe was inflated thus filling the greater part of the thoracic cavity. In the air-filled space that was not filled by the lobe, two catheters of the width Nelaton No 21, were inserted, one backwards towards the area of the mediastinal suture and the other upwards towards the top of the pleura in order to ensure continuous suction drainage.

The postoperative course was complicated by an infection in the cavity after the excised upper and middle lobes, but nevertheless the bronchial suture healed primarily and never caused any bronchial fistula. As the infection would not heal in spite of suction drainage through the two catheters, drainage had to be established on Sept 29, by rib resection, when a cavity, the size of a fist, was dried with tampons. The empyemic cavity then gradually shrank and after the patient had been treated with daily dressings at home for 4 months, it was closed by the insertion of a pedunculated muscle flap on Aug 27, 1940. She was discharged on Sept 18, without any signs of relapse.

*Macr description* In a section through the upper lobe of the left lung fixed in formalin when inflated, a tumour twice the size of an egg, and somewhat coarsely nodulated on the section area, was seen in its central part, a portion of which, somewhat larger than a hazelnut protruded like a polypus into the bronchus of the upper lobe in the direction of the hilus. Both the polypoid and the intrapulmonary part of the tumour was pierced by profuse, comparatively fresh haemorrhages. To the naked eye the whole tumour appeared to be separated from the pulmonary parenchyma by a comparatively thick capsule of connective tissue. This latter displayed considerable induration and chronic pneumonitis, as well as small solitary abscesses.

*Micro description* In numerous sections both through the central and peripheral parts of the lung tumour it is found to be a fibroepithelial tumour belonging to the group of mucous- and salivary-gland tumours. It is made up of fairly large, pale, and in places almost cylindrical cells with a comparatively uniform rounded nucleus poor in chromatin (see Fig 1). The cells of the tumour are mostly arranged so as to form spindles and strings, separated by a fine connective tissue stroma comparatively poor in cells, and here and there distinctly hyaline. In certain areas more compact arrangements of cells are seen. Here and there some slightly adenoid structures filled with fresh blood are encountered. Also in the sections, the tissue of the tumour is found to be separated from the surrounding pulmonary parenchyma by a firm and fibrous connective tissue capsule, very thick in some places. In the inner layers of this capsule, minor ruptures are seen here and there facing the tumour, through which the latter breaks out into the connective tissue in a hernial manner. Outside these parts of the tumour, however, there is another capsule of connective tissue which is adherent to the capsule closest to the main tumour. The impression is thus created that the tumour breaks out into the surroundings in some places, but a careful study reveals that the parts of the tumour outside the capsule are separated from the surrounding tissues by a thick connec-

tive tissue capsule everywhere. In the sections a considerable number of fairly large lymphatic glands are found, which are separated from the tumour tissue everywhere by connective tissue capsules, even though the tumour often grew quite close to the glands. In the intrapulmonary part of the tumour one also finds, that when growing in the walls of minor bronchial branches, it penetrates these here and there, and forms new small polypi in their lumina. The pulmonary tissue adjoining the tumour displays considerable atelectasis, haemorrhages and fibrous induration, as well as small areas subjected to chronic pneumonic changes.

*Pathologic-anatomical diagnosis.* Fibroepithelial tumour belonging to the group of mucous- and salivary gland tumours. No signs of malignancy. Considerable secondary pulmonary changes, namely chronic induration, chronic pneumonia, and atelectasis.

### Case 2

K I 2041/39. A 39-year old man.

Previously on the whole well. Periodical lung symptoms since the autumn of 1937. These were coughing attacks and high temperature, that the patient experienced in Oct. and Nov. 1937 and in June 1938. Roentgenographic examination disclosed bronchopneumonic changes in the basal parts of the left lower lobe both times. In Nov. 1938 a similar attack, but this time there was also blood-stained sputum, which the patient had not had before.

In April 1939 a period of high temperature and a slight cough. Suffered from a hacking cough during the summer and autumn of 1939. Roentgenographic control on Nov. 30, 1939, when a tumour was suspected for the first time.

On account hereof, the patient was admitted to the Sabbatsberg Hospital. Bronchoscopy, on Dec. 5, 1939, showed that the bronchus of the left upper lobe was almost completely obstructed,  $\frac{1}{2}$  cm from its departure, by a greyish-red, firm tumour.

Biopsy disclosed tumour tissue of the type of a mucous- and salivary-gland tumour without any signs of malignancy.

Left-sided thoracotomy acc. to CRAFOORD on Dec. 15, 1939. The 6th rib was removed. The upper lobe was atelectatic and almost twice the size of a fist. The lower lobe was considerably expanded, and containing air throughout. The upper lobe was adherent to the thoracic wall all the way round.

During the preparation it was found that the tumour had developed like an hour-glass tumour with a polypoid part, the size of the end of the forefinger, growing into the lumen of the bronchus of the upper lobe, and a somewhat larger part, about the size of a walnut, growing outside the wall of the bronchus of this lobe and into the pulmonary tissue. These two parts were connected by a thin stalk through the bronchial wall, between two annular cartilages. By resection of the bronchus of the upper lobe,  $\frac{1}{2}$  cm from its departure from the main bronchus, it was possible to remove all tumour tissue radically, the upper lobe being removed at the same time. The bronchial stump was closed typically according to CRAFOORD. It was sewn over with peri-

bronchial tissue, whereupon the mediastinal wound was covered with pleural tissue. The thorax was closed primarily according to CRAFOORD.

Healed without complications and was discharged on Jan 17, 1940 at which time the wound had healed completely.

Bronchoscopic control in Feb 1940 and in Feb 1941 without any signs of relapse. At the same time roentgenographic control. Only normal conditions were found.

*Micro description* I Biopsy at bronchoscopic examination. The small pieces of tissue excised are partially coated with a low, flattened epithelium reminding of a squamous epithelium. Here and there, there is no epithelial coating, and the subjacent tissue is uncovered. Just beneath the epithelium there is a solid tumour, consisting of fairly small, rounded cells, with a comparatively small rounded or oval nucleus, rather rich in chromatin. No mitoses are found. The tumour cells are arranged in fairly densely packed spidices and strings, the numerous ramifications of which combine to form a rather finemeshed network. The spidices are separated by a connective tissue comparatively poor in cells and here and there they are slightly hyaline, and it is striking, that in many places the nuclei of the tumour cells are turned away from the connective tissue (see Fig 2). The tumour is rather rich in blood vessels, and it is pierced by fresh haemorrhages in many places. Immediately beneath the surface of the tumour there are numerous expanded blood vessels with comparatively thin walls. No distinctly adenoid structures can be observed anywhere, but in mucicarmine-coloured sections a limited quantity of mucicarmineophilous substance is encountered here and there in the loose connective tissue between the tumour cells. The histological structure of the tumour in all essentials agrees with that of a fibroepithelial tumour belonging to the group of mucous- and salivary-gland tumours. No signs of malignancy.

## II The upper lobe of the left lung (operation specimen)

*Macro examination* The extirpated lobe was fixed in a distended state by inflating formalin vapour into the bronchial tree. When the lobe was sectioned, the main bronchus was found to contain a polypoid tumour, the size of a white bean, which almost completely obstructed its lumen. Around the polypus there is extensive cylindrical and saccular bronchiectasis and also seats of chronic pneumonia.

*Micro examination* The polypoid tumor presents a histologic structure, in all essentials similar to that outlined above. The tumour, which appears to have emanated from the mucous glands of the bronchial mucous membrane, displays no signs of infiltration. Extensive, comparatively fresh haemorrhages are seen especially in the neighbourhood of the apex of the polypus. As in the biopsy, the surface of the polypus is coated with a thin layer of flattened cells in a few places, but generally there is no epithelial coating and the surface is abundantly covered with fibrin containing leukocytes. The mucous membrane in the cylindrical and saccular bronchiectatic cavities is strongly lymphoplasmoleukocytically infiltrated, and in the parts of the lung adjoining the bronchi, similar, though not quite so pronounced cellular infiltration is seen. Within minor circumscribed areas some mostly

healed seats of chronic pneumonia of non-specific character are also seen. In these examined parts of the lung there were no signs of tumour infiltration.

*Pathologic-anatomical diagnosis.* Polypoid fibroepithelial tumour belonging to the group of mucous- and salivary-gland tumours. No signs of malignancy. Extensive secondary bronchiectasis and minor seats of chronic pneumonia are found in the lung.

### Case 3

K I 218/40. A 65-year old woman.

Earlier history of no interest. Since about 1925—1930 the patient had now and then suffered from a hacking cough in autumn and spring, interpreted as chronic bronchitis. In connection with an attack of this cough, the patient was examined by a physician in Jan. 1940 and a rounded shadow, suspected to be caused by a tumour, was observed in the left pulmonary field on roentgenographic examination. The shadow was localized to the anterior central part of the lobe. She was then sent to the Sabbatsberg Hospital for further examination.

A thorough clinical examination could demonstrate no other tumour of which the pulmonary tumour might be a metastasis, and the diagnosis arrived at was primary pulmonary tumour. Owing to the roentgenological aspect of the tumour and the completely negative bronchoscopic findings it was considered most likely to be a benign tumour.

Thoracotomy was performed on March 22nd, 1940, when the 4th rib was exposed and extirpated from the sternum to the anterior axillary line. The free upper lobe was pulled out in the wound. At the place indicated by the roentgenogram a polycyclically isolated walnut sized tumour was found. A small piece of the capsule was excised for histological examination. As this piece displayed no signs of malignancy local extirpation of the tumour and capsule was made. Primary suture.

Healed without complications. The patient was discharged on March 16. Roentgenographic controls since then at 2-monthly intervals. No signs of relapse.

*Micro description.* The removed walnut sized tumour has a fatty section surface. Some parts of the tumour are covered by a regular high columnar epithelium of the respiratory type. In the loose connective tissue beneath the respiratory epithelium a small island of cartilage is found in one place. The other parts of the tumour are not covered by epithelium, but they are isolated by a thin connective tissue capsule in some places. Just inside the capsule or beneath the respiratory epithelium, the solid tumour follows, consisting of densely packed, regular, polygonal cells with an oval nucleus comparatively poor in chromatin. Only a few isolated mitoses are found. Between the cells of the tumour there is a fine-meshed stroma of connective tissue, rather rich in blood vessels but poor in cells, and also a coarser moderately hyaline network of connective tissue fibrils. In many places, especially in the central parts of the tumour, the cells adjoining the coarser connective tissue networks are arranged in long regular lines, and the nuclei are here seen to be distinctly turned away from the connective tissue (see Fig. 3). In mucicarmine coloured sections a limited

*Micro description* The tumour growing into the bronchus of the lower lobe like a polypus, is in parts coated with a comparatively high columnar epithelium of the respiratory type. Generally, however, it is very stretched and consists of one or a couple of layers of flattened cells, here and there resembling squamous epithelium. Beneath this follows a fibrous connective tissue poor in cells, which forms a capsule around the tumour. Inside this capsule islands of tumour cells are seen.

The tumour issues from the wall of the bronchus with a fairly broad base directly adjoining the mucous membrane of the bronchus as well as its annular cartilage. The tumour capsule appears to merge directly into the perichondrium of that cartilage, in which scattered small spadicies of tumour cells are found. The capsule is not seen to be distinctly pierced anywhere.

The tumour consists of rounded or polygonal, comparatively small cells with a round nucleus, fairly poor in chromatin, in which no mitoses are to be found. The tumour cells are arranged in spadicies and strings, separated by a comparatively fine stroma, composed of connective tissue poor in cells, distinctly hyaline in some places. A striking feature is that the nuclei of the tumour cells are frequently turned away from the connective tissue. The latter is slightly mucicarmophilous. No pronouncedly basalioma-like or cylindromatous structures are seen anywhere.

The histological structure of the tumour agrees with that of a fibro-epithelial tumour belonging to the group of mucous and salivary-gland tumours.

In the vicinity of the base of the tumour, and on the border between the bronchus and the pulmonary tissue there is a highly anthracotically pigmented lymphatic gland, without any signs of metastases. The lung tissue in the specimen contains air throughout and displays no pathological changes worth mentioning. Just below the apex of the tumour there is another lymphatic gland resembling the one just described.

A renewed study of the material excised at bronchoscopy, shows, that it has a histologic structure that in all essentials agrees with certain parts of the bronchial tumour examined later.

*Pathologic-anatomical diagnosis* Benign, polypoid, fibro-epithelial tumour in the lower lobe of the right lung, its appearance being that of a mucous and salivary-gland tumour. No lymphatic gland metastases demonstrated. Peripherally to the tumour slight cylindrical bronchiectasis.

## B

### From the trachea

#### Case 5

Ear diary No 1168/31 A 35-year old woman

In the autumn of 1930 the patient began to experience a troublesome inclination to cough, and a thick feeling in the throat, inhalation being impaired. Otherwise well. Admitted into a hospital on Aug 1,

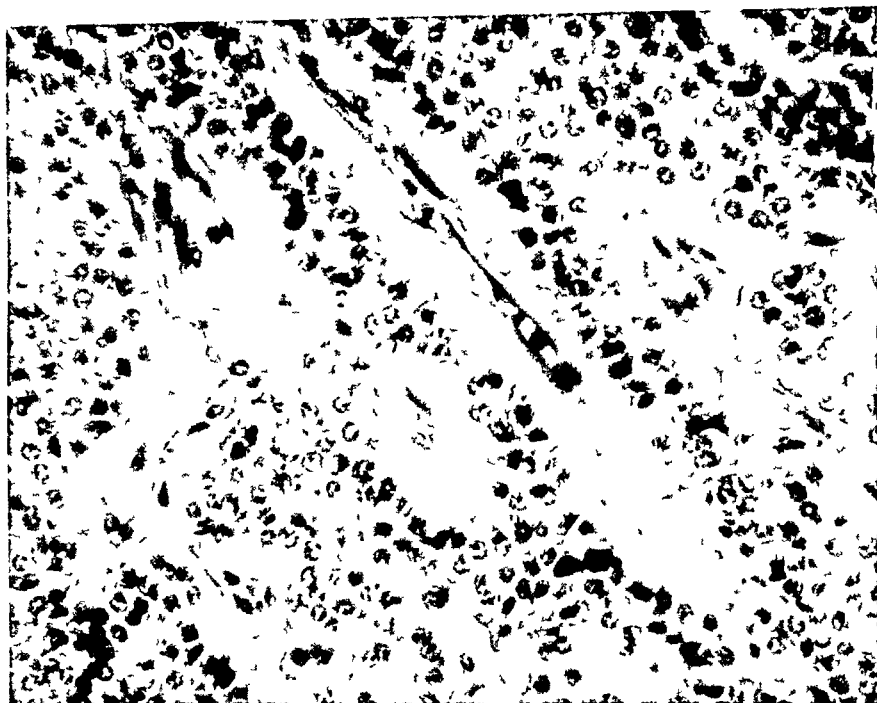


Fig 1 Case 1 Benign mucous and salivary gland tumour The nuclei in the tumour cells distinctly turned away from the connective tissue Dyeing ace to Ladevig 350  $\times$

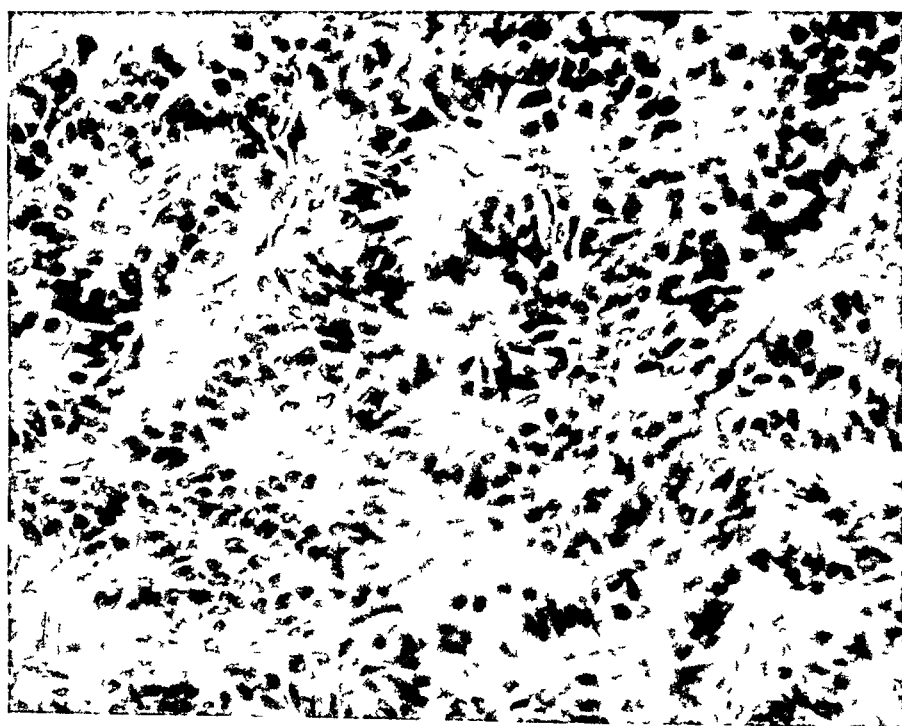


Fig 2 Case 2 Benign mucous and salivary gland tumour  $\times$  Giesson 350  $\times$

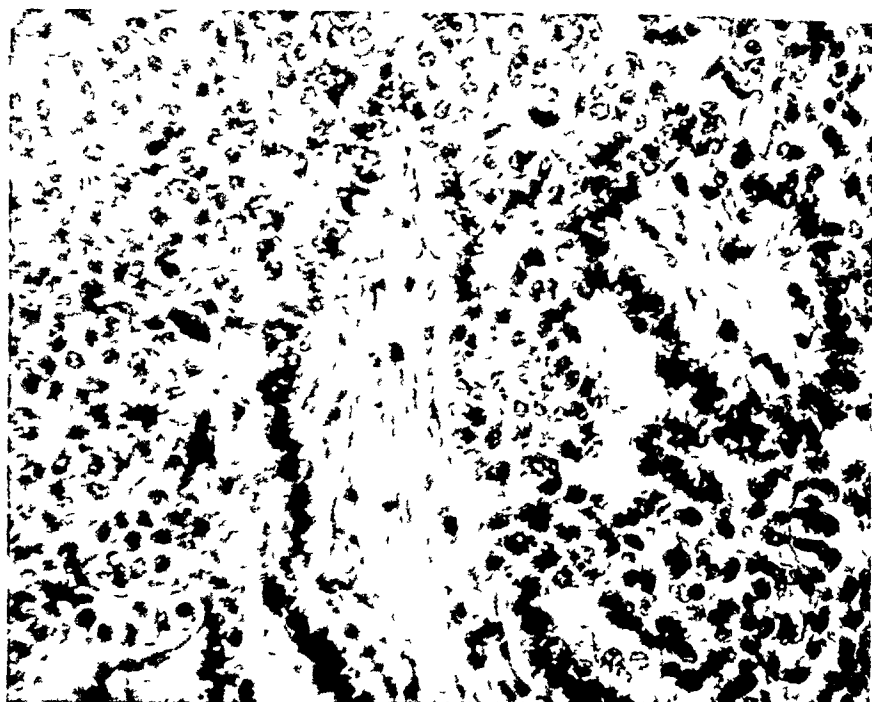


Fig 3 Case 3 Benign mucous and salivary gland tumour  $\times$  Gieson 250  $\times$

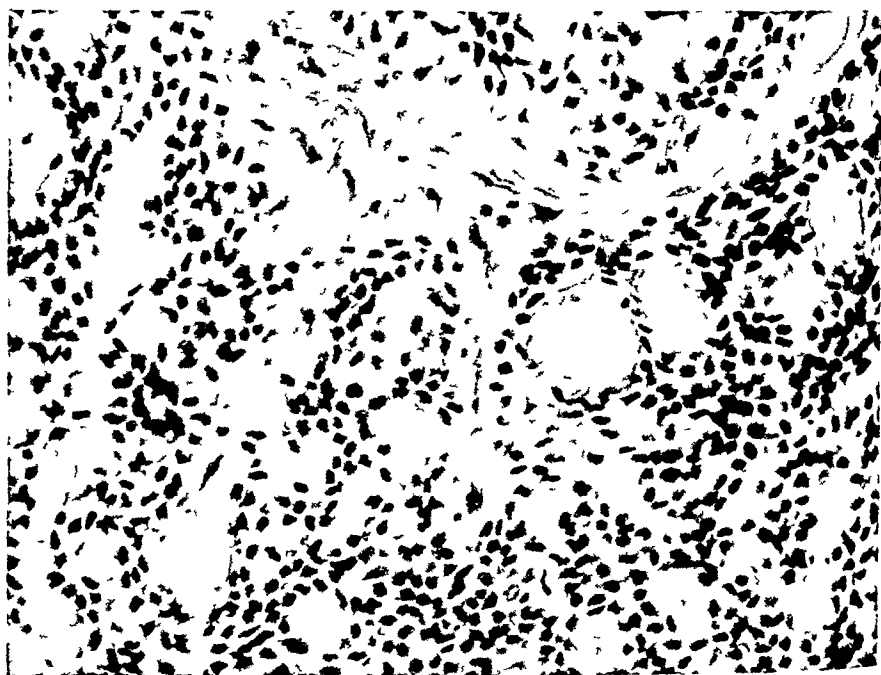


Fig 4 Case 5 Benign mucous and salivary gland tumour Profuse quantities of mucicarmineophilous substance Mucicarmine dyeing 350  $\times$ .



Fig 5 Case 8 Semi malignant mucous and salivary gland tumour and changes similar to *tracheopathia chondro osteoplastica* Virchow H&A eosin 45  $\times$

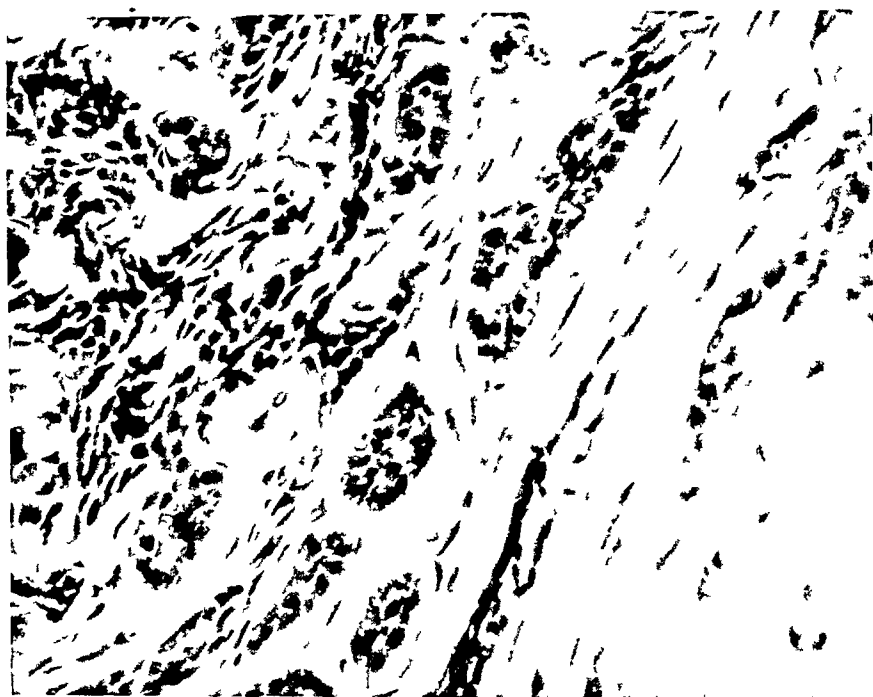


Fig 6 Case 12 Semi malignant mucous and salivary gland tumour infiltrating the perichondrium Mucicarmine dyeing 350  $\times$

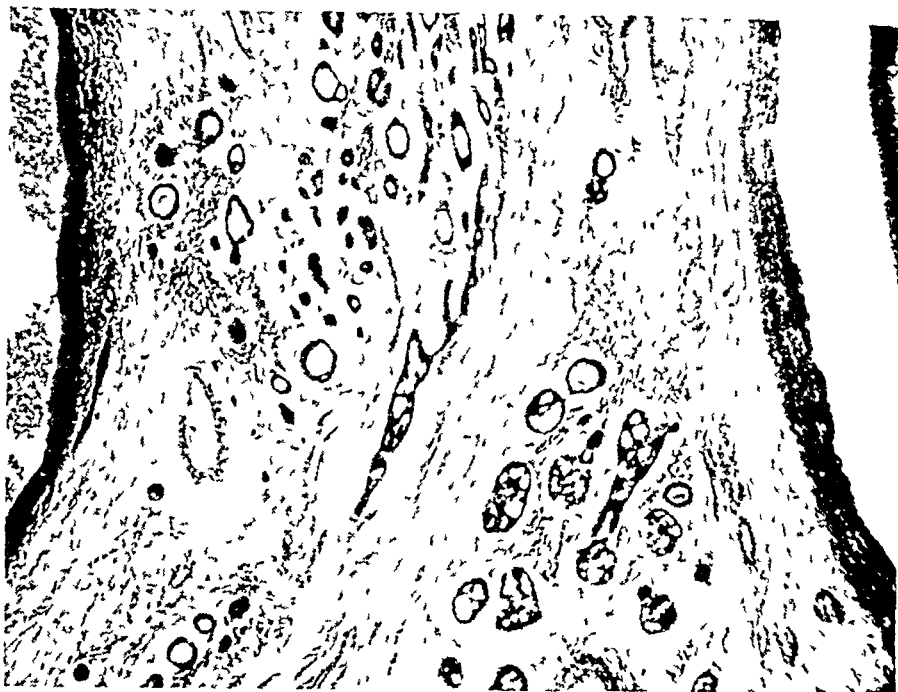


Fig 7 Case 13 Malignant mucous and salivary gland tumour. Pronouncedly infiltrative growth between the bronchus and the blood vessel. Ht\ eosin 45 /



Fig 8 Case 13 Tumour invasion in lymphatic gland. Ht\ eosin 45 /



Fig 9 Case 14 Malignant mucous and salivary gland tumour Initiating invasion into marginal sinus in a lymphatic gland (at the crease in the specimen)  
Htx eosin 15 X.



Well until 1937 without any signs of relapse, working as usual, when an acute infection in the upper respiratory tract set in, followed by pneumonia. He died at home after two days. No autopsy.

*Micro examination* The material submitted consists of a fibro-epithelial tumour belonging to the group of mucous- and salivary-gland tumours. The tumour cells are small and contain small rounded nuclei rich in chromatin in which no mitoses can be demonstrated. The tumour cells are arranged in small compact aggregates or larger spicules, in the centre of which large quantities of mucicarmineofilous substance is seen. Between the spicules there is a fairly loose connective tissue. In many places the nuclei of the cells are turned away from the connective tissue. The relationship to the surrounding tissue cannot be studied on the basis of the material submitted. Histologically the tumour appears benign.

*Pathologic-anatomical diagnosis* Probably benign, fibroepithelial tumour, belonging to the group of mucous- and salivary-gland tumours with distinct cylindromatous structures.

#### Case 7

A 13-year old girl

Unfortunately the diary cannot be found

#### *Data from Radiumhemmet*

Increasing stridor during the past 2 years. Bronchoscopy at the Vanersborg Hospital on Sept 8th, 1938, disclosed a tumour at the bifurcation of the trachea. Biopsy. Pathologic-anatomical diagnosis: Malignant tumour, probably sarcoma.

On account of increasing breathing difficulties she was sent to the Sabbatsberg Hospital on Sept 23rd, 1938. Bronchoscopy now disclosed a tumour on the posterior wall of the trachea. It grew downwards and almost completely occluded the two main bronchi. Biopsy. Pathologic-anatomical diagnosis (REUTERWALL) Malignant tumour of basal-cell carcinoma type, belonging to the group of mucous- and salivary-gland tumours.

*Micro examination* The small tumour is about the size of a white bean and is coated with a regular mucous membrane, covered by epithelium of the respiratory type. The tumour tissue is made up of small cubical or polygonal cells with a small nucleus rich in chromatin. The tumour cells are arranged so as to form festoon-like aggregates, separated by a loose connective tissue fairly rich in blood-vessels. As a rule the nuclei of the tumour cells are turned away from the connective tissue. Mucicarmine-dyeing slightly positive. The histologic structure of the tumour agrees almost completely with that described in connection with Case 2.

*Pathologic-anatomical diagnosis* Benign fibroepithelial tumour belonging to the group of mucous- and salivary-gland tumours.

## II

Clinically Benign but Histologically suspected  
Malignant Tumours.

## A

## From the bronchi

*Case 8*

K II 1459/37 A 47-year old woman

Asthma trouble since her youth In 1917 "pulmonary catarrh" with a high temperature In 1925 persistent troublesome bronchitis In 1931 dry pleurisy Neither then nor in a later control examination did the roentgenogram disclose anything indicating a tumour Up to the beginning of Aug 1937 asthma-like trouble as before, but no difference between these troubles and those she had suffered from all her life Aug 2nd, 1937, a slight hemoptysis On account of this, roentgenogram on Aug 4th, 1937, when a tumour-like stenosis of the bronchus of the left lower lobe was found

Bronchoscopy disclosed, that the main bronchus of the left lower lobe was almost completely filled by a nodular tumour, just below the departure of the bronchus of the upper lobe Biopsy disclosed a tumour of epithelial character The appearance indicated malignancy, but the small pieces did not allow any detailed classification

Thoracotomy on Aug 12th, 1937, acc to CRAFOORD On account of the infiltrative growth of the tumour in the bronchial wall all the way up to the departure of the bronchus of the upper lobe, total extirpation was decided upon The extirpation was carried out acc to CRAFOORD without any great technical difficulties

During the postoperative course the patient displayed signs of bronchopneumonia in the lower and middle lobes on the right side, and she succumbed to this complication on Aug 23rd

*Macr description* The left lung was fixed by inflating formalin vapour In the anterior lateral part of the upper lobe, an elongated greatly retracted area about the size of the end of the thumb is found, with a thickened and buffy pleural coating, under which a deeply situated firmer area can be palpated The rest of the lung has a smooth pleura and is of normal density In the stump of the main bronchus, the resection edge of which is free from tumour, a flat movable tumour, about the size of a white bean is seen at the first branching with a broad upper base growing into the lumen like a polypus, and which to all appearances could swing backwards and forwards and practically occlude the bronchus of the lower lobe The bronchi of the lower lobe, however, display no great changes In the basal parts of the left lower lobe there are some minor seats of catarrhal pneumonia From the site of the polypus, the bronchus of the upper lobe is considerably thickened some distance towards the periphery and its lumen is distinctly constricted The pulmonary tissue beneath the retracted area displays extensive

cylindrical and saccular bronchiectasis, giving a honeycomb appearance to the section area of the lung. Just underneath the pleura there is a fibrous area, which at microscopical examination is seen to consist of atelectatic pulmonary tissue, showing chronic pneumoma of unspecific character.

*Micro examination.* As in the excised piece of tissue the polypoid tumour proves to be a fibroepithelial tumour belonging to the group of mucous- and salivary-gland tumours. It consists of small, somewhat polygonal cells with a comparatively small and rounded nucleus, generally fairly poor in chromatin. No mitoses can be demonstrated. The tumour cells are arranged as fine spindices and strings, separated by a connective tissue fairly poor in cells and considerably hyaline. In numerous places the nuclei of the tumour cells are seen to be distinctly turned away from the connective tissue. Mucicarmine-dyeing slightly positive. Here and there the tumour presents a Lasalioma- or cylindroma-like appearance. Where the bronchus of the upper lobe bifurcates to form the first ventral and dorsal branches, one also finds plenty of tumour tissue, partly outside the annular cartilages. In the bronchial wall the tumour grows in a distinctly infiltrative manner, but in the section areas it is always separated from the lung tissue by a fibrous connective tissue, and it does not grow in between the pulmonary alveoli.

Also in the more peripheral parts of the lung, the tumour protrudes like a polypus into the lumen of the bronchus, after having broken through the mucous membrane, thus constricting the lumen to a great extent. In several places of the sections, more or less rounded seats of spongy bone containing bone-marrow are seen connected to the bronchial cartilage. The changes very much resemble those characterizing *tracheopathia chondroosteoplastica Virchowii* (See Fig. 5). It is remarkable that tumour tissue is frequently found inside the above-mentioned islands of bone-marrow. Whether this is to be interpreted as an infiltrative growth or not is doubtful.

Both in the tumour tissue and in the bone-marrow islands, fresh epithelioid-cell tubercles with minor cheesy necroses are encountered here and there close to the tracheal cartilages. In the lung tissue, on the other hand, it has not been possible to demonstrate any definite tuberculous changes.

Neither in the sections through the lung, nor in a lymphatic gland situated close to the bronchial stump and remitted separately, can signs of tumour metastases be found, and one cannot demonstrate any metastases at the autopsy. In the upper lobe of the right lung a healed primary tuberculous lesion is found, and a calcified lymphatic gland is found in the right hilus.

*Pathologic-anatomical diagnosis.* Polypoid fibroepithelial tumour belonging to the group of mucous- and salivary-gland tumours. The tumour grows infiltratively in the bronchial wall, but not in the pulmonary tissue proper, and no metastases have been demonstrated. Secondary bronchiectasis, atelectasis and chronic pneumonia in a limited part of the left upper lobe.

## Case 9

K I 1868/41 A 49-year old woman

Nothing hereditary of interest 4 children On account of severe albuminuria after the last delivery, she was sterilized 1933 amputation uteri + oophorectomy on account of haemorrhages and a right-sided ovarian cyst Pathologic-anatomical diagnosis No signs of malignancy

Apart from pleurisy on the left side in 1909, no lung symptoms until Feb 1941, when she suddenly experienced pain in the vicinity of the heart, this being interpreted by the doctor as myocarditis In bed for a few days, then the symptoms disappeared In Sept 1941 a sudden hemoptysis, a few c c of frothy blood Once more in Sept and once in Nov similar small hemoptyses Therefore the patient was admitted into sanatorium where the diagnosis *tumor pulm sin (susp cancer bronch)* was arrived at with the aid of roentgenogram and bronchography, which disclosed a constriction of the left main bronchus and of the bronchus of the left upper lobe Because of this the patient was sent here for further examination

Bronchoscopy showed a constriction of the main bronchus at the level of the departure of the bronchus of the upper lobe and a constriction of the latter to a slit-shaped lumen A peg-shaped slightly bleeding tumour protruded from the bronchus of the lower lobe Biopsy then disclosed a fibroepithelial tumour belonging to the group of mucous- and salivary-gland tumours of a semi-malignant character, and as great pulmonary changes also must exist peripherally to the bronchus-stenosing tumour, thoracotomy and total lung extirpation was decided upon and carried out on Jan 23rd, 1942 A moderate amount of adhesions were encountered but they were easily dealt with No metastases could be observed The hilar glands were distinctly enlarged but palpation disclosed no metastases

On account of the great pulmonary changes present, total lung extirpation was carried out typically according to CRAFOORD the vessels and the bronchial stump being dealt with according to CRAFOORD The operation was accomplished without complications and the patient's condition was satisfactory throughout

During the postoperative course auricular fibrillation occurred but receded after the administration of digitalis Subsequently treated with sulfathiazol and there were no infectious complications, the wound healed primarily and the temperature was normal 2 weeks after the operation

In the third week again subfebrile and then the patient lay for more than 2 months with a subfebrile temperature, the only demonstrable cause of which was the pleural exudate on the operated side The exudate soon became strongly fibrinous and could not be checked by tapping, only small quantities were obtained and no growth of bacteria was obtained Possibly some mediastinal bronchial stump-insufficiency existed, but no reliable clinical confirmation was ever obtained hereof Early in May the temperature was normal, however, and the patient could be discharged healed on May 12th

*Macr description* In sections through the distended left lung, fixed in formalin-vapour under positive pressure, the medial upper part of the lower lobe is found to contain a fairly firm, greyish white tumour, almost the size of a tangerine, somewhat coarsely nodular on the section area, and issuing from the bronchus of the lower lobe To the naked eye the tumour appears to be well delimited everywhere, generally encapsulated, and its peripheral part borders on a cyst, almost as big as an orange, with a slightly trabeculated wall, and lacking liquid contents In the lowest, slightly atelectatic part of the lower lobe considerably ectatic bronchi are seen, filled with pus-mixed mucus No regional lymphatic glands demonstrated

*Micro description* As was indicated by the piece of tumour previously excised, the tumour proves to be a fibroepithelial tumour, belonging to the group of mucous- and salivary-gland tumours The tumour cells are small, rounded or somewhat oval, and possess a small nucleus comparatively rich in chromatin, in which no mitoses can be observed The tumour cells are arranged as fine spadices separated by a strongly hyaline connective tissue poor in cells In certain parts of the tumour large compact parts with a very fine stroma appear Here and there the connective tissue is found to contain numerous fusiform cavities from dissolved cholesterol crystals Especially in the parts of the tumour where the cells form fine spadices, the nuclei of the cells are frequently distinctly turned away from the connective tissue, which is mucicarminofilous in many places There are no distinctly cylindromatous structures anywhere On the outside the tumour is generally delimited by a fibrous capsule of varying thickness, which here and there contains tumour spadices Only in one place do tumour spadices grow through the capsule penetrating into the adjoining somewhat atelectatic pulmonary tissue, thus the tumour should probably be called semi-malignant

*Pathologic-anatomical diagnosis* Semi-malignant fibroepithelial tumour belonging to the group of mucous- and salivary-gland tumours Peripherally to the tumour a solitary pulmonary cyst and cylindrical bronchiectasis

#### *Case 10*

K I 1135/42 A 48-year old man

Nothing hereditary of interest Apart from lues in 1915, which healed after treatment The Wassermann reaction has been constantly negative since Nothing of interest in the earlier case-history

The patient had pleurisy on the right side in 1918, but since then no trouble from the respiratory organs until the autumn of 1939 when, as in the spring of 1941, he had rather long lasting attacks of bronchitis "of asthmatic type" with a wheezing sound in the chest

In Dec 1941 an acute attack with increased cough, temp 40°, for the first time blood-stained sputum and the sputum quantities increasing to about 10 c c of greenish white expectorate The acute symptoms disappeared after a week but the cough remained constant during the entire winter of 1942 On account of this he was admitted into the Sabbatsberg Hospital, Med Dep III Bronchoscopy disclosed a bulging

and slightly bleeding tumour 2 cm below the carina in the left main bronchus, obliterating the main bronchus and causing a complete atelectasis of the lower lobe. Biopsy disclosed a semi-malignant mucous- and salivary-gland tumour. The upper lobe seemed to be intact. Owing to the great secondary changes in the right lower lobe, lobectomy had to be carried out, and the intention was to try to save the normal air-containing upper and middle lobes.

Operation May 28th, 1942 Thoracotomy acc to CRAFOORD. Some adhesions between the lower lobe and the surrounding tissues are easily divided. The interlobar groove of the lower lobe distinct all the way into hilus. Upper and middle lobe intact. Nothing pathological could be found in the mediastinal glands on palpation. No metastases were observed. Therefore ideal lobectomy of the lower lobe acc to CRAFOORD was performed. Tube drainage. Primary suture.

The postoperative course was without complications and the patient could be discharged healed on June 18th, three weeks after the operation.

*Macr description* In sections through the distended lung fixed by formalin vapour moderately developed cylindrical bronchiectasis is found in the lower lobe but no definite rests of the tumour are seen macroscopically.

*Micr description* The material obtained at the biopsy is partly coated by a low, flattened, squamous epithelium, beneath which the loose connective tissue contains extensive, partly infiltrative growth of a typical fibroepithelial tumour belonging to the group of mucous- and salivary-gland tumours. The tumour cells are generally cubical but in places low cylindrical, the nucleus being distinctly turned away from the loose, fine stroma of connective tissue, which is comparatively rich in blood-vessels. Scattered cylindromatous structures are observed, the cavities being filled with mucicarminofilous substance. Also in the stroma, which is somewhat hyaline in places, there is a similar occurrence of mucicarminofilous substance. In the operation specimen, the wall of the bronchus of the lower lobe is found to contain minor rests of the tumour, growing in a fibrous connective tissue which is poor in cells, compressed to resemble a capsule, containing scattered tumour spicules. Just outside the tumour capsule, there is a comparatively large lymphatic gland, but nowhere does the tumour display a tendency to grow through the capsule into the lymphatic gland. In addition numerous other lymphatic glands are encountered in the sections, all free from metastases. In view of the infiltrative growth of the tumour in the covering mucous membrane and in the surrounding capsule of connective tissue, it should probably be called semi-malignant.

*Pathologic-anatomical diagnosis*, Fibroepithelial tumour belonging to the group of mucous- and salivary-gland tumours. Histologically the tumour is of a semi-malignant character. Peripherally to the tumour, the lower lobe presents moderately pronounced cylindrical bronchiectasis but no inflammatory changes to speak of.

## B

## From the trachea

*Case 11*

Ear diary 1268/35 A 78-year old woman

Well earlier For about 6 months before being admitted into the hospital on Sept 11th, 1935, she had suffered from an irritating cough and a choking feeling, the latter being especially troublesome when she walked faster than usual Otherwise she felt quite well

Bronchoscopy on Sept 11th, 1935, disclosed a tumour, the size of a fingerend, 2 cm below the rima glottidis, that is smooth on the surface, issuing from the posterior wall of the trachea The tumour is about 3 cm in diameter

The biopsy disclosed a tumour of mucous- and salivary-gland type without any signs of malignancy Later operation and extirpation of the tumour

She was sent to Radiumhemmet for radiation treatment, and has been under observation there the whole time since, receiving treatment, partly roentgen and partly radium in different series, the last time in March 1936 Since then no further treatment but she was observed repeatedly during the years 1935, 1937, 1938, and 1940, and the last time on April 28th, 1941, without showing any signs of tumour metastases The tumour, which after the last treatment shrank to a knob the size of a pinhead, issuing from the posterior tracheal wall at the site of the tumour, has changed neither in size nor in shape during the last years

*Micro description* I In the sections, the small piece of excised tissue is seen to lack epithelial covering and consists of a fibroepithelial tumour belonging to the group of mucous- and salivary-gland tumours The tumour cells are small and have a small rounded nucleus rich in chromatin No mitoses can be demonstrated The tumour cells are arranged as small compact aggregates or larger spadicies, in the centre of which large quantities of mucicarminofilous substance is seen Between the spadicies there is a comparatively loose connective tissue In many places the nuclei are found to be turned away from the connective tissue The relationship to the surrounding tissue cannot be studied in the material remitted

II Histologically the extirpated tumour presents the same appearance as the excised material just described The tumour is partly coated with a mucous membrane with respiratory epithelium and the border between them is not sharp Otherwise there is nothing to indicate malignancy

*Pathologic-anatomical diagnosis* Semi-malignant fibro-epithelial tumour belonging to the group of mucous- and salivary-gland tumours with pronounced cylindromatous structures

*Case 12*

Ear diary 705/30 A 20-year old woman

Clinical data unfortunately not available

*Data obtained*

For the past 3 years shortness of breath and hoarseness Stridor when breathing all the time, approximately unchanged

Direct tracheoscopy disclosed an infiltrating tumour in the trachea When extirpated it seemed to issue from the thyroid gland, infiltrating the tracheal wall

*Micro description* The excised tracheal tumour is partly coated by a regular, respiratory epithelium Under the latter in the tracheal mucous membrane there is a tumour made up of regular, somewhat polygonal cells with an oval nucleus comparatively rich in chromatin No mitoses demonstrated The tumour cells are arranged to form irregular, fairly densely packed spicules, in the centres of which cavities filled with mucicarminophilous substance are seen Between the spicules a loose connective tissue is seen, that is slightly hyaline in some places The tumour grows close around the tracheal cartilage, piercing the perichondrium in several places (See Fig 6) Tumour spicules are also encountered on the outside of the tracheal wall and they penetrate the connective tissue to a great extent in an infiltrative manner In the sections there is none of the thyroid tissue mentioned in the report of the operation

*Pathologic-anatomical diagnosis* Fibroepithelial tumour belonging to the group of mucous- and salivary-gland tumours with pronounced cylindromatous structures Fairly pronounced infiltrative growth

## Clinically and Histologically Malignant Tumours.

### A

#### From the bronchi.

##### *Case 13*

K I Diary no 658/36 A 46-year old man

Since about 1929 the patient had now and then noticed a wheezing sound in the upper part of the chest, and he had at the same time had an irritating cough He had an acute attack in March 1935 with signs of a pulmonary process on the left side, which his physician interpreted as pneumonia without resolution The patient had a high temperature for three months, after which he was sent to a sanatorium The roentgenogram then suggested tuberculosis Treated at sanatorium from July, 1935, to March 14, 1936 During the period of observation no tubercle bacilli could be demonstrated Tumour was suspected and the patient was sent to Prof JACOBÆUS, Serafimerlasarettet, Stockholm, where the diagnosis stenosis of the left main bronchus due to a tumour, was arrived at on the basis of bronchoscopy and biopsy The excised material gave no definite clue as to the nature of the tumour

Explorative thoracotomy on April 21st, 1936, The left lung was extirpated and the vessels were dealt with separately The left main bronchus was dealt with acc to CRAFOORD It proved to be a tumour growing diffusely in the hilus with an encapsulated protrusion, pene-

trating into the mediastinum and dislocating the esophagus to the right

However, the tumour also grew infiltratively towards the pericardium around the upper pulmonary vein. Therefore resection of the pericardium was carried out around that vein, which was dealt with intrapericardially. The resected piece of the pericardium was about 3—4 cm in diameter. The defect could be closed by a pericardial suture. The thorax was closed primarily acc to CRAFOORD. The postoperative course was complicated by an empyema on the left side, that enforced a drainage operation.

During the period Aug 12th to 29th, 1936, the patient was at Radiumhemmet, where he received radiologic postoperative treatment (1500 r).

Later it was necessary to carry out several drainage operations on account of the empyema, and also a thoracoplastic operation, thus the patient could not be discharged until Oct 6th, 1939, when the wounds were definitely healed, except for a small fistula, 10—12 cm deep and of the width of a probe, running from the scar up towards the top of the pleura.

After the operation no signs of local recurrence. According to a letter in 1942 well, and doing light farming work.

*Macr description* In sections through the lung fixed in formalin vapour when distended, a firm, greyish white tumour is seen at the hilus as big as a hazelnut and polycyclically delimited on the section. The tumour encloses and strongly constricts the larger branches of the bronchus in a cuff-like manner, especially those of the upper lobe. Especially in that lobe very pronounced cylindrical and saccular bronchiectasis is seen and between these there is a firm and fibrous pulmonary tissue, displaying changes of chronic pneumonia, so that the upper lobe has the appearance of a so-called honeycomb-lung. In the lower lobe minor bronchiectasis is seen only in the uppermost part of the lobe. To the naked eye the boundary between the tumour and the surrounding pulmonary tissue appears to be comparatively sharp.

*Micro description* The tumour is made up of small, somewhat polygonal cells, with a small nucleus rich in chromatin. The tumour cells are arranged so as to form fine spadices, in the central parts of which, there are rounded cavities filled with mucicarminofilous substance. The spadices are separated by distinctly hyaline connective tissue comparatively poor in cells, and here and there it can be observed that the nuclei of the tumour cells are turned away from the connective tissue.

Also in the sections, the tumour tissue is seen to surround the coarser bronchi like a wide cuff infiltrating the mucous membrane. The tumour cannot be observed to have penetrated into the lumen of the bronchi. In the stroma of the mucous membrane, moderate round cell infiltration is seen, and a limited quantity of leukocytes is present. In a few places, where no tumour growth is seen in the mucous membrane, the latter is ulcerated in very small areas.

The tumour grows in a pronouncedly infiltrative way around comparatively thick vessels even into the media, and also around the

bronchi (see Fig 7) On the border between the tumour and the surrounding pulmonary tissue a distinctly infiltrative growth can be demonstrated in several places This pulmonary tissue is the seat of very extensive chronic inflammatory changes such as indurative chronic pneumonia, partly with fatty alveolar contents and here and there with minor chronic abscesses

In sections through separately remitted lymphatic glands from the hilus, a moderate anthracosis is seen close to the bronchial stump The lymphatic glands have a considerably thickened fibrous capsule of connective tissue poor in cells and outside it there is an abundant infiltrative growth of tumour spicules, which penetrate in between the nerves in the connective tissue and also from the outside grow into the superficial parts of a lymphatic gland (see Fig 8) In this case the occurrence of a lymphatic gland metastasis is thus established

*Pathologic-anatomical diagnosis* Malignant fibroepithelial tumour belonging to the group of mucous- and salivary-gland tumours Pronounced basaloma- and cylindroma-like structures Considerable infiltrative and also destructive growth demonstrated, and also a lymphatic-gland metastasis Great secondary pulmonary changes in the form of bronchiectasis and chronic pneumonia

#### Case 14

K I Diary No 788/38 A-65 year old woman

Well earlier In 1930 pneumonia on the left side, treated in hospital for 4 months Tuberculosis suspected though never demonstrated Since then suffered from cough with expectoration but not ill otherwise, though always tired In 1936 again treated in hospital, the diagnosis being pneumonia on the left side, pleurisy at the same time After two months home again, then cough as before but no special feeling of being ill until Feb 1938, when the cough increased and the sputum amounted to as much as 500—600 ml daily

Of late tired, poor appetite and loss in weight As pulmonary tumour was suspected, the patient was sent to the Sabbatsberg Hospital for examination in the Surgical Department

Bronchoscopy showed that, on the level of the bronchus of the upper lobe, the left main bronchus was occluded by a lump of tissue emanating from its ventrolateral aspect It was smooth on the surface and bled slightly when touched Biopsy Under the microscope it displayed no signs of tumour but only chronic inflammatory changes of a non-specific character The roentgenogram disclosed signs of stenosis of the left main bronchus with a decreased air-content of the lung, thus causing a displacement of the mediastinum to the left and emphysema in the right lung In the left lung signs of extensive bronchiectasis

The diagnosis being stenosing process of the main bronchus of the left lung, probably of tumour character in spite of the negative findings in the biopsy, and great destruction of the lung peripherally to the stenosis being established, exploratory thoracotomy was decided upon with great hesitation, at the urgent request of the patient and her relatives

Incision acc to CRAFOORD with extirpation of the 5th rib The lung was adherent everywhere It was released and extirpated after separate treatment of the main bronchus and the vessels In this case the bronchus could not be invaginated, a simple edge suture had to be used instead and centrally of the latter a moderately tight ligature was applied

The postoperative course was complicated by an empyema which had to be drained Discharged on Aug 24, 1938, after 4 months in hospital, and sent to a hospital in her home town for continued treatment A week before the discharge the patient received postoperative roentgen treatment at Radiumhemmet

According to information received later the patient succumbed to the complicating empyema, which caused an occlusion of the upper part of the pleural cavity, that was not drained by the old thoracotomy incision in its posterior lower part The autopsy disclosed no macroscopic or microscopic signs of recurrence

*Macr description* The upper lobe of the left lung is strongly atelectatic, and of a tough, firm consistency In several sections it proves to contain numerous saccular and cylindrical bronchiectatic cavities filled with pus, some as thick as the little finger Around and in the bronchus of the upper lobe, a firm tumour the size of an almond is seen, with a diffuse boundary towards the surrounding parts The lumen appears to be completely occluded by the tumour The lower lobe displays no very great changes

*Micro description* The tumour is made up of not very small, polygonal, fairly polymorphous cells with a comparatively profuse fair and frequently vacuolized protoplasm and an irregularly rounded nucleus Most of the nuclei are vesicular and fairly poor in chromatin but others are rich in chromatin and pycnotic in some places A limited number of mitoses demonstrated

The tumour cells are arranged to form spadices and strings separated by a fine stroma consisting of a strongly hyaline and fibrous connective tissue poor in cells Here and there the nuclei of the tumour cells are seen to be turned away from the connective tissue

The boundary between the tumour and the surrounding connective tissue is diffuse and from the tumour rounded protrusions penetrate the tissue between the neighbouring vessels, the annular cartilages in the bronchus of the upper lobe, the mucous glands etc In the sections numerous large and small lymphatic glands are seen near the tumour In one of these glands a tumour-spadix penetrates into the marginal sinus and proliferates towards the interior of the gland (see Fig 9) Sections through the bronchial stump disclose tumour-spadices all the way out to the resection edge

Peripherally to the stenosing bronchial tumour the lung also displays strong atelectasis histologically as well as extensive bronchiectasis and chronic pneumonia of non-specific character

*Pathologic-anatomical diagnosis* Fibroepithelial tumour belonging to the group of mucous- and salivary-gland tumours

Cellular polymorphism, mitoses, a decidedly infiltrative growth, and initiating metastasis in a lymphatic gland, show the malignant charac-

ter of the tumour The degree of malignancy, however, does not appear to be very great

Secondary atelectasis, chronic pneumonia and bronchiectasis in the upper lobe of the left lung

### Discussion.

Mucous- and salivary-gland tumours (KROMPECHER) comprise "partly tumours which have long been called 'tumours of the large salivary glands of the mouth' or 'salivary-gland tumours' and partly similar tumours which occur particularly within or in the neighbourhood of mucous membranes provided with serous, seromucous and mucous glands" (MASSON, HERRENSCHMIDT, THERKELSEN, AHLBOM, and others) (Cited AHLBOM, p 13)

A small number of such tumours, issuing from the trachea and the bronchi, have been described earlier (GEIPEL, KRAMER, WESSLER & COLEMAN, BOENKE, and others) The about two hundred frequently polypoid tumours that are now generally called "benign bronchial adenomata" in the literature, have not hitherto been classified as belonging to the mucous- and salivary-gland tumours JACKSON and KONZELMANN (1937) for instance certainly describe their 12 cases, from which the diagnosis can be obtained without any great difficulty, but the authors themselves do not speak of the similarity between these "adenomata" and mucous- and salivary-gland tumours in other places HAMPERL points out the similarity between such tumours and carcinoids in the intestinal canal and to cylindromas Recently A F FOSTER-CARTER of Brompton Hospital in London and HUSFELDT of Copenhagen have pointed out when describing tumours of this kind that they are probably identical to the mucous- and salivary-gland tumours These questions were discussed with both of these authors in our department long before their articles were published

The tumours described by us agree in their structure with such so-called bronchial adenomata and in our opinion they undoubtedly belong to the group of mucous- and salivary-gland tumours, which certainly the so-called bronchial adenomata earlier described by other authors also do In the salivary glands, for instance, real *adenomata* can develop, but these tumours are extremely rare and their structure differs from that of the real mucous- and salivary-gland tumours Nor do they resemble the so-called bronchial adenomata or our cases

All our cases have been fibroepithelial tumours generally made up of not very polymorphous cells in which the nucleus has frequently been turned away from the connective tissue. The cells have been arranged so as to form strings and rows separated by a sometimes sparse, sometimes profuse, fibrous, and here and there hyaline connective tissue poor in cells, which in most cases has given a positive mucous reaction. Some of the tumours have presented pronouncedly cylindromatous structures, (Cases 5, 6, 11, 12, 13) and in one case (13) also basaloma-like aspects. Most of the tumours have a fairly well developed capsule of connective tissue, in which there are sometimes isolated islands of tumour tissue without this being a sign of infiltrative growth. In a couple of cases the tumour pierces the capsule but also here the tumour-spaces are delimited by an amount of connective tissue so that a hemioid picture arises.

The majority of the tumours are thus histologically benign, whereas others (Cases 8, 9, 10, 11, and 12) display a certain local malignancy, *e g* by piercing the capsule, as was just mentioned. Such cases are called semi-malignant by MASSON and REUTERWALL (cf AHLBOM's monograph).

Two cases (13, 14), finally, display both clinical and histological signs of malignancy such as infiltrative growth and invasion of regional lymphatic glands. To all appearances, however, the degree of malignancy of these tumours is low.

The question of possible variations in the biological character of the mucous- and salivary-gland tumours is very difficult to answer. As has been emphasized especially by AHLBOM, it is not sufficient to establish a long anamnesis ( $> 5$  years) to be able to conclude that the tumour is originally of a benign histological character. Thus some cases have been followed for many years with repeated biopsies and it has proved that from the very beginning the tumour presented the same histological appearance as in later malignant stages. In our material no more than one biopsy ever preceded the extirpation of the tumour and consequently we do not know anything about the histological appearance of the tumour in earlier stages. In the material of Radiumhemmet (reported by AHLBOM) it has never been possible to establish a change from benign to malignant mucous- and salivary-gland tumour, whereas a few semi-malignant tumours seemed to have been able to produce clinically observable malignancy after a long time. In the great majority of cases, however, the tu-

mour displayed the same histological picture at an early stage as several years later. As we have already said, we do not know how our cases have behaved in this respect, but we consider that many factors favour the belief that the tumours in the two cases termed malignant (13, 14) should have been called "semi-malignant" at a comparatively early stage and that they did not manifest their malignant character until later by causing metastases in the regional lymphatic glands. It is striking, however, how "reluctantly" the latter process developed. The tumour tissue appears but slowly to invade the lymphatic gland *per continuitatem*. Tumours of this kind thus sometimes display a local malignancy rather than a development fatal to the patient. Thus our cases also in this respect agree with the mucous- and salivary-gland tumours of other localities. Just as distant metastases occasionally arise *e g* from a mucous- and salivary-gland tumour in the parotid gland, such metastases can of course be expected also when the primary tumour is situated in a bronchus, but our material includes no such case.

The tumours in our material are comparatively small which undoubtedly is partly due to their slow growth, and partly to their localization in the respiratory channels, on account of which the tumour in several cases grew as a polypus into the lumen and comparatively early occluded it. In our cases, as in the cases of so-called bronchial adenomata described in the literature, it was the bronchial stenosis and its symptoms that brought the patient to the doctor.

Roentgenological examination especially of the bronchial system and first of all bronchoscopy combined with biopsy gives the diagnosis.

As regards the treatment it can be radical as experience has shown and result in complete healing in early cases by local operations through the bronchoscope. When using this method however, one can never be sure of having removed the tumour completely. Two of our cases (13, 14) show that the so-called benign bronchial adenomata can display a malignant character both histologically and biologically by growing infiltratively outside their original capsule and cause lymphatic-gland metastases. We therefore consider it wrong to advise the removal of only those parts of the tumour that produce the bronchial occlusion and of greatly changed parts of the lung as do certain authors (WOMACK & GRAHAM, GOLDMAN & STEPHENS, and others), without trying

to remove the whole tumour radically. This method is said to be safe because the slow growth of the tumour allows one to leave small rests of it. The latter, it is claimed, can grow for decades without producing any clinical symptoms and never change their biologically benign character and become malignant. In view of the malignant character of two of our tumour cases, we consider however, a radical removal of the tumour in cases of this kind to be definitely indicated, if such a removal is technically possible.

### Addendum

Since this article was completed in 1942, another 13 cases have been operated. In 4 cases pneumonectomy was performed, in 9 cases lobectomy. Of these 12 healed primarily without complications and 1 died.

As the printing of this article has been substantially delayed owing to unforeseen circumstances, two articles, one by J. ENGELBRITZ-HOLM 1944 and one by E. HUSFELDT 1942 have been printed in *Acta Chirurgia Scandinavica* on the same subject. As far as we can judge the impulses to both these articles must have emanated from the work concerning these tumours that we started in 1939.

### Summary.

1 Our material of so-called bronchial adenomata comprises 14 cases, the tumour being localized to the bronchi in 9 cases and to the trachea in 5.

2 The tumours have by us been demonstrated to belong to the group of mucous- and salivary-gland tumours, and like such tumours in other places they can be classified as benign, semi-malignant (MASSON, REUTERWALL) and malignant (of ours 7 were benign, 5 semi-malignant, 2 malignant).

3 The classification of the tumours in question as mucous- and salivary-gland tumours explains both the clinical course of the cases and the biological character of the tumours.

4 Tumours of this kind are generally benign, but sometimes display signs of a certain local histological malignancy by growing infiltratively, destructively and by causing metastases. Also in the malignant cases, however, the degree of malignancy generally appears to be low.

5 We consider it indicated that tumours of the type in question be radically removed, if technically possible, as the malignancy or non-malignancy of the tumour is difficult to determine histologically in excised material. It is a known fact that so-called semi-malignant mucous- and salivary-gland tumours can occasionally in the course of time change to decidedly malignant tumours. Especially tumours with basalioma-like structures seem to have this tendency.

### Zusammenfassung.

1 Unser Material an sog. Bronchialadenomen umfasst 14 Fälle, und zwar sass der Tumor in 9 Fällen in den Bronchen und in 5 Fällen in der Trachea.

2 Wir haben nachgewiesen, dass die Tumoren zu der Gruppe der Schleim- und Speicheldrüsentumoren gehören, und wie Tumoren dieser Art an anderen Stellen lassen sie sich in gutartige, halbmaligne (MASSON, REUTERWALL) und bösartige einteilen (von unseren Fällen waren 7 gutartig, 5 halbmalign und 2 malign).

3 Die Klassifizierung der betreffenden Tumoren als Schleim- und Speicheldrüsengeschwulste erklärt sowohl den klinischen Verlauf der Fälle als auch den biologischen Charakter der Tumoren.

4 Tumoren dieser Art sind im allgemeinen gutartig, bieten aber manchmal Anzeichen einer gewissen örtlichen histologischen Malignität dar in Form von infiltrativem und destruktivem Wachstum und Setzen von Metastasen. Doch scheint auch in den bösartigen Fällen der Grad der Malignität zumeist eingegränzt zu sein.

5 Wir halten es für indiziert, Tumoren dieser Art, wenn es technisch möglich ist, radikal zu entfernen, da es an exzidiertem Material schwer ist, die Malignität oder Benignität des Tumors histologisch festzustellen. Ein bekanntes Faktum ist, dass sog. halbmaligne Schleim- und Speicheldrüsentumoren hin und wieder einmal im Laufe der Zeit in entschieden maligne Tumoren übergehen können. Besonders Tumoren mit basaliomähnlichen Strukturen scheinen diese Neigung aufzuweisen.

### Résumé.

1. Notre matériel d'adénomes bronchiaux comprend 14 cas, dans 9 cas, la tumeur étant localisée dans les bronches et dans 5 cas dans la trachée.

2 Nous avons démontré que ces tumeurs appartiennent au groupe des tumeurs des glandes muqueuses et salivaires et que, comme ces dernières, dont la localisation varie, elles peuvent être classifiées en tumeurs bénignes, semi-malignes (MASSON, REUTERWALL) et malignes (dans 7 de nos cas il s'agissait de tumeurs bénignes, dans 5, de tumeurs semi-malignes et dans 2, de tumeurs malignes)

3 La classification des tumeurs en question dans le groupe des tumeurs des glandes muqueuses et salivaires explique à la fois et l'évolution des cas et le caractère biologique des tumeurs

4 Les tumeurs de cette sorte sont généralement bénignes, mais elles prennent parfois un caractère de malignité histologique locale en infiltrant et en détruisant les tissus normaux et en causant des métastases. Mais même dans les cas malins, la malignité est peu prononcée

5 Nous recommandons l'extirpation totale de ces tumeurs si elle est pratiquement possible, car il est malaisé de faire le diagnostic histologique de malignité. C'est un fait connu que des tumeurs semi-malignes peuvent au cours du temps évoluer vers la malignité. Dans les cas de tumeurs à structure de caractère basalo-mateux, cette tendance semble être particulièrement prononcée

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## **Splenectomy in Chronic Non-leukemic Myeloid Splenomegaly with Report of a Case with Osteosclerosis.**

By

HOLGER BUKH and TORBEN K WITH

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It is generally acknowledged that operative removal of the spleen in cases of splenomegaly due to myeloid metaplasia is often fatal and splenectomy is practically never performed in cases diagnosed as leukemia. In the non-leukemic forms of myeloid metaplasia of the spleen — here designated as chronic non-leukemic myeloid splenomegaly — splenectomy is, however, continually performed from time to time and most often with fatal issue in spite of HICKLING's (1937) work which clearly shows that the operation is contra-indicated in such cases. It therefore seems indicated once more to review the reaction of chronic non-leukemic myeloid splenomegaly to splenectomy and to point out ways by which the diagnostic errors which lead to splenectomy in these cases may be avoided.

### **Chronic Non-leukemic Myeloid Splenomegaly.**

By chronic non-leukemic myeloid splenomegaly we understand an enlargement of the spleen caused by myeloid metaplasia with more or less preserved structure, more or less hypertrophy of the splenic reticulum and fibrosis, and as a rule well-pronounced erythropoiesis as well as the occurrence of megakaryocytes — often numerous — in the spleen.

This disease has been described under several names, *e g*, "Splénomégahe myéloide sans myélocythémie" (RATHERY, 1902),

"Aleukämische, besser nicht leukämische Myelose" (MAVROS, 1931), "Splénomégalie myéloïde mégacaryocytaire amyélocythémique" (HUGONOT & SOHIER, 1935), "Chronic non-leukemic myelosis" (HICKLING, 1937), and "Agnogenic myeloid metaplasia of the spleen" (JACKSON *et al*, 1940) — but most of the cases published are simply designated as aleukemic or subleukemic myeloid leukemia or myelosis

The reasons why this disease has to be separated from the leukoses will not be discussed here in detail, the reader is referred to HICKLING's (1937) and JACKSON's *et al* (1940) discussion of the subject. Further, it can be stated that authors of well-known textbooks are of the opinion that "chronic aleukemic myeloid leukosis" is not a real leukemia (*cf* HELLY in HENCKE & LUBARSCHE'S Handbook, Vol 1, p 1029, 1927, SCHILLING, 1933, p 289 *et seq*). Of considerable interest in this respect is moreover that TRANSBØL (1942) by repeated injections of foreign proteins on rabbits has succeeded in producing disease pictures greatly resembling the different forms of manifestations of chronic non-leukemic myeloid splenomegaly (*e g*, myeloid metaplasia of the spleen with hyperplastic marrow as well as with sclerotic or atrophic marrow and even well-pronounced osteosclerosis, often the spleens of the rabbits were very large). His interesting experiments — which are unfortunately only published in Danish — point to the possibility that allergy may play a prominent part in the pathogenesis of chronic non-leukemic myeloid splenomegaly.

As to the nomenclature of the disease we have preferred the term "chronic non-leukemic myeloid splenomegaly" because the myeloid transformation of the spleen is the central feature of the disease. "Non-leukemic" designates more clearly than "aleukemic" that the disease does not belong to the leukoses and the term "myelosis" is to be avoided as it designates the disease as a leukosis. The term "agnogenic" used by JACKSON *et al* does not seem very suitable to us as it only means "of unknown origin" — a predicate which may with equal right be attached to the splenomegaly of myeloid leukosis.

A detailed discussion of the pathology and clinical symptomatology is omitted here, we may refer to the reviews of HICKLING and JACKSON *et al*. It is, however, to be pointed out that both the picture of the bone marrow and the clinical picture show considerable variation. The marrow may be hyperplastic, normal or sclerotic, and in the last case — known as myelosclerosis — the bones are often more or less sclerotic too (osteosclerosis), detailed descriptions of the histolog-

ical findings in myelosclerosis and osteosclerosis are found by GRIESHAMMER (1937) and APITZ (1938). It is worth noting that some parts of the marrow may be sclerotic and others hypertrophic, that osteosclerosis may be very irregularly distributed (SCHMORL, 1904, CHAPMAN, 1933, HEWER, 1937, DOWNEY & NORLAND, 1939, HYNES, 1940, LUPSCHITZ, 1942), and that in this way a gradual transition from cases with total sclerosis of the bone marrow to cases with hyperplastic marrow without sclerosis may occur — for without knowing this it is difficult to believe that such extremely different conditions of the marrow may be found in the same disease. Another interesting feature is also that myelosclerosis seems to be the result of an inflammation (GRIESHAMMER, APITZ, TRANSBOL).

As splenomegaly is the most constant feature of the disease it may seem close at hand to regard the splenomegaly as primary. In the cases of myelosclerosis with widespread destruction of the marrow the splenomegaly must, however, at least partly be secondary to the sclerosis of the marrow as it plays an important part in the hemato-poiesis, and the most reasonable explanation of the pathogenesis of the disease is perhaps to assume a factor which at the same time operates upon the spleen and the bone marrow. Also other localizations of extramedullary hematopoiesis than the spleen may be found, but they are generally considered less pronounced and widespread than in myelogenous leukosis. The liver is, however, frequently considerably enlarged due to myeloid infiltration.

As the picture of the bone marrow varies greatly the blood picture may simulate a great number of blood diseases very closely. Also the other clinical features show pronounced variation, the spleen may be moderately or enormously enlarged, hepatomegaly may be absent or pronounced — or even enormous, ascites, jaundice, hemorrhagic diathesis and swelling of the lymph glands may be present or absent — apart from hemorrhagic diathesis the latter symptoms are, however, only seldom seen — etc etc.

It is, consequently, easy to understand that the diagnosis of the disease may be very difficult, only by means of close observation is it possible to distinguish it from certain forms of leukosis, polycythemia, thrombopenic purpura, splenic depression of the bone marrow, carcinosis of the bone marrow, hemolytic jaundice, certain forms of aplastic anemia and last but not least Banti's disease. As splenectomy is performed as a treatment in several of the diseases mentioned and is most often fatal in chronic non-leukemic myeloid splenomegaly, it is obvious that the correct differential diagnosis between these diseases may be of vital importance to the patient.

The disease may be seen at any age, but most often the middle-aged and old are affected. It is seen in both sexes, but seems to be somewhat more frequent in women than in men. In children

it is extremely rare, but nevertheless, some typical cases have been described in newborn (ASMANN, 1907, Case 4, GODALL, 1912) as well as in infants (OESTERLIN, 1923, HASSLER & KRAUSPE, 1933, ANDERSEN & LUND, 1943)

Chronic non-leukemic myeloid splenomegaly is generally believed to be a rather seldom disease, but this is principally due to the fact that the cases are published under various designations. The cases which are described in France by ÉMILIE-WEIL and his associates under the term "Érythroblastose chronique de l'adulte" (WEIL & PERLÈS, 1938) are presumably for the greater part belonging to this group, and this is also the case with many "aleukemic" or "subleukemic" myeloid leukoses as well as most of the so-called osteosclerotic anemias. In this connection it is to be emphasized that it may in some cases be very difficult to decide whether a given case belongs to real myeloid leukemia or to chronic non-leukemic myeloid splenomegaly as all transitions between the typical pictures of these two diseases may occur, and even by means of autopsy it may be impossible to settle the diagnosis finally in some cases. Many clinicians and pathologists have hitherto used the diagnosis leukemia in cases in which the diagnosis of chronic leukemoid reaction would have been more correct and thus probably registered many cases of chronic non-leukemic myeloid splenomegaly as leukosis.

### Writers' Case.

Our patient was a married workman aged 48. Apart from dyspepsia during 10—15 years he had had no diseases of importance until a few months before his admission to the county hospital at Sæby on July 7, 1942. During these months he had lost weight and his dyspeptic complaints had increased. On admission a greatly enlarged, firm and smooth spleen reaching the level of the umbilicus as well as a liver an inch below the costal margin was found. No ascites or collateral circulation. The patient looked emaciated and old. The hemoglobin percentage was 100 and the white blood picture was normal. Without further examination the diagnosis of Banti's disease was made and splenectomy was carried out on August 7. The postoperative course was uneventful. The spleen weighed 1,250 g. The patient was discharged on September 9 with no change in the dyspeptic complaints.

*Histologic examination of the spleen removed by operation* (Chief-pathologist, A. SOEBORG OHLSEN, M. D.) "The splenic capsule is thickened and shows fibrous changes and the trabeculae consist of fibrous tissue poor in cells and with a few muscle fibres. The fine arborisations of the septa are surrounded by herds of lymphocytes. The pulp

consists of rather slender reticulum cells, in its spaces numerous myelocytes, erythroblasts, normoblasts, polymorphonuclear leukocytes and erythrocytes as well as some lymphocytes and scattered megakaryocytes are seen. Among the myelocytes both neutrophils and eosinophils are found. The very pronounced extramedullary hematopoiesis is striking. The well-preserved corpora Malpighi speak against leukemia."

On September 22, 1942 the patient was readmitted to the Medical Department of the County Hospital at Slagelse.<sup>1</sup> He had lost 10 kg in weight since the operation and had pains in the lower extremities. For blood examinations see the table. The average diameter of the red corpuscles was  $8.2 \mu$ , the icterus index 3 and the percentage of normoblasts 1.5. X-ray examination of the stomach revealed a large ventricular ulcer (large air-containing niche on the lesser curvature) and the benzidine reaction was positive in the feces. Sternal puncture was performed twice and both times the examiner observed that the bone was unusually hard. The patient was discharged on October 21 after treatment with iron and sedatives. His condition was unchanged.

*Examination of sternal marrow* (puncture October 10, Chief pathologist, A. SÆBORG OHLSEN, M.D.) "Differential count of the blood film gave the following values: Myeloblasts 0.25 %, promyelocytes 0.50 %, neutrophil myelocytes 8.50 %, eosinophil and basophil myelocytes 0 %, metamyelocytes and staff-nuclears 10.50 %, neutrophil polymorphonuclears 57.00 %, eosinophils 5.50 %, basophils 0 %, lymphocytes 17.75 %, no monocytes, plasmocytes, megakaryocytes, reticulum cells or Ferrata cells. For every 400 cells of the 'white system' the following number of cells of the 'red system': erythrogonia 1, basophil erythroblasts 5, eosinophil erythroblasts 5. The marrow biopsy achieved by the puncture thus contains considerable amounts of peripheral blood which speaks against leukemia. The biopsy shows lively myelopoiesis which is associated with leukocytosis of the peripheral blood."

The patient was readmitted to the hospital at Sæby on November 11, 1942 as the pains in his legs had grown worse. He showed severe anemia and was restless and plaintive. He was transferred to the Medical Department A of the Rigshospital where he stayed from November 28, 1942 to April 12, 1943. During his stay in the hospital his weight decreased from 57.9 to 52.2 kg (height 172 cm). He had pains in the cardia and the lower extremities, and in January 1943 he had a severe gastric hemorrhage (melaena) followed by a pronounced fall of the hemoglobin percentage (cf. the table). Two blood transfusions (400 and 500 ml) as well as iron and liver treatment were not followed by any increase of the hemoglobin. His condition gradually grew worse as the intensity of the pains increased and he became more and more restless in spite of liberal administration of narcotics. The temperature was normal except for a short period simultaneously with the melaena. X-ray examination of the stomach showed a large ulcer at

<sup>1</sup> For permission to use the hospital record of the patient we bring Chief Physician, H. AASTRUP, M.D., our sincerest thanks.

the lesser curvature The liver was felt 3 cm below the costal border There was no swelling of the peripheral lymph nodes The urine showed no pathologic findings and SCHLESINGERS urobilin test was positive at the highest dilution  $1/_{10}$  The Wasserman reaction was negative The blood sedimentation (WESTERGREN) was between 4 and 10 mm in one hour The serum cholesterol was 0.222 per cent (G. BRUN's method), the serum protein 6.8 per cent and the serum calcium 9.5 mg per 100 ml The fragility of the red blood corpuscles was beginning at 0.48 and complete at 0.24 per cent NaCl The bleeding time was  $1\frac{1}{2}$  minutes, the coagulation time  $1\frac{1}{2}$  minutes, and the capillary resistance normal (no petechiae in Bexelius' test)

*Biopsy of lymph node* Fibrosis and reticulosis without myeloid metaplasia

*Sternal punctures* (December 2 and 11) The sternum was harder than usual The punctures were so strongly admixed with peripheral blood that a differential count of the marrow was impossible

As the anemia had developed after the splenectomy and the sternum was found to be hard by several sternal punctures the diagnosis of osteosclerotic anemia was ventilated, and radiography of the osseous system carried out

*Radiography of osseous system* (Chief radiologist, Professor P. FLEMING MOLLER, M.D.) "The osseous structure of the columna is very pronounced, especially in the fifth lumbar and first sacral vertebrae, and the space between these two vertebrae is narrowed The right humerus and right tibia show very strong bone lamellae and are undoubtedly the seat of osteosclerosis The pelvic bones also show osteosclerosis and the cranial bones too are dense and the theca thick The outlines of the bones are all normal and clearly visible"

After his discharge from the Rigshospital the patient was transferred to the County Hospital at Sæby, but there he became so restless that it was necessary to transfer him to a hospital for mental diseases At his request he was, however, discharged to his home for some days, but here he committed suicide on May 5, 1943 The body was transferred to the hospital at Sæby and autopsy carried out

*Autopsy* (Chief surgeon, FOLMER SØEGAARD) The liver weighed 2,200 g The stomach showed an old scarred ulcer The other organs showed no macroscopic pathologic changes Of the bones, only the costae and the sternum were examined and showed no signs of sclerosis

Microscopical examination (Chief pathologist, L. HEERUP) "The liver shows slight cloudy swelling and some staff-nuclear granulocytes and dubious myelocytes as well as a few megakaryocytes in the sinusoids, but otherwise a normal structure The kidneys are normal The sternum shows a thin osseous shell and poorly developed spongy tissue The marrow (section and smear) is very rich in cells and practically without fat cells The myelopoiesis is dominating with many polymorpho-nuclears and staff-nuclears, chiefly neutrophil, as well as numerous myelocytes and a few myeloblasts Further there is pronounced hyperplasia of the erythropoietic system There are only a few lymphocytes"

Table 1.  
*Blood Counts in Writers' Case*

Date	Hb %	Er	C I	Leuk	N %	Mv %	E %	B %	L %	Mo %	NR %	Thr
Aug 1, 42	100	No count Smear showed normal blood picture										
Sept 23, 42	82			31,440	72	0	7	0	13	8	0	0.96
Oct 9, 42				34,220	82	1	2	0	12	3	0	
Oct 20, 42	87											
Nov 6, 42	62											
Nov 30, 42	45	2.78	0.73	32,200	75	0	7.5	0	9	7	1.5	
Dec 2, 42				34,200								
Dec 8, 42	51											
Dec 11, 42	52											
Dec 16, 42	41	2.51	0.73	28,100	70	0	11	0	10	6	3	
Dec 28, 42	49	Transfusion of 400 ml blood										
Dec 29, 42	55											
Jan 2, 43	35	Gastric hemorrhage (melena)										
Jan 4, 43	29	Transfusion of 500 ml blood										
Jan 7, 43	30											
Jan 12, 43	34											
Jan 18, 43	36	2.29	0.75	14,400	66.5	0	4.5	0	7	6.5	15.5	
Jan 28, 43	37	2.32	0.75	18,000	78	0.5	6.5	0.5	9	5.5	0	
Feb 11, 43	41	27/1—16/2 "Exhepa fortior" 5 ml i m was given										
Feb 18, 43	38	twice a week, the reticulocytes varied irregularly										
March 4, 43	38	between 1.5 and 4.6 % during this period										
March 13, 43	39	3.08	0.61	24,300	63	0	15	0	15	1	6	0.61

#### Red blood picture

The red blood picture showed at all examinations pronounced anisopoikilocytosis and polychromatophilia. The reticulocyte count was 1.5—4.6 %. From time to time a single erythrocyte with punctate basophilia. The nucleated red cells were partly normo- and partly polychromatic.

*Abbreviations used in the table* Er = erythrocytes in millions, Leuk = leukocyte count, Thr = thrombocytes in millions, C I = color index, N = neutrophil granulocytes, Mv = myelocytes, E = eosinophil granulocytes, B = basophil granulocytes, L = lymphocytes, Mo = monocytes, NR = nucleated red corpuscles in per cent of the number of leukocytes.

*Epicrisis* A man aged 48 with greatly enlarged spleen and slightly enlarged liver without ascites and with normal blood picture is subjected to splenectomy under the diagnosis of Banti's disease. Microscopic examination of the spleen shows pronounced myelo- and erythropoiesis. After the operation anemia and leukocytosis gradually develop. The case is complicated by an old bleeding gastric ulcer. Sternal punctures show hard sternum and the X-ray diagnosis of osteosclerosis is made. In spite of various kinds of treatment — blood transfusions, iron and liver extract — the anemia progresses and the patient's condition becomes

untenable because of pains in the legs which make large doses of narcotics necessary, and finally he commits suicide. At autopsy no osteosclerosis is found — only the sternum and ribs are examined — and the findings speak against leukemia, as the erythropoiesis of the sternum is hyperplastic. Also the well-developed lymphatic follicles of the spleen speak against leukemia.

### Discussion.

In our case it is somewhat surprising that the osteosclerosis could not be demonstrated post mortem. Here it is, however, to be remembered that only the sternum and the ribs were examined and that osteosclerosis may be very irregularly distributed within the osseous system (*cf.* above). On radiography of the patient osteosclerosis was demonstrated neither in the sternum nor in the ribs but in most other bones.

An interesting and dominating symptom in our case is the pains in the legs. Such pains are described in several cases of osteosclerosis (MAYROS, 1931, CHAPMAN, 1933, Case 1, ANANGOSTU, 1933, STEPHENS & BREDECK, 1933, Case 1, METTIER & RUSK 1937, Case 1, CARPENTER & FLORY, 1941).

Our case has several features in common with the leukoses but also several pointing against leukemia. The blood was practically free from immature cells during the entire course, the erythropoiesis of the sternal marrow was hyperplastic and the lymphatic follicles of the spleen were well preserved. So, it is most natural to classify the case as chronic non-leukemic myeloid splenomegaly.

### The Cause and Consequences of Splenectomy in Chronic Non-leukemic Myeloid Splenomegaly.

As pointed out above, chronic non-leukemic myeloid splenomegaly may resemble very closely several diseases which are generally acknowledged as indications for splenectomy, and it is thence natural that splenectomy has often been done in this disease on false indications. We have tried to collect all cases of chronic non-leukemic myeloid splenomegaly treated with splenectomy which have been published in the world literature. This has not been an easy task as the cases are described under many different names, we have searched in text-books, mono-

graphs, reviews and in the indices under the diagnoses under which the cases most likely have been published, as aleukemic leukosis and splenic anemia, as well as under the diagnoses under which the cases more rarely are hidden, such as polycythemia, hemolytic jaundice, etc. Only the literature since 1900 has been gone through, as the earlier hematological diagnostic methods can scarcely have justified the differential diagnosis between leukosis and chronic non-leukemic myeloid splenomegaly.

In the *schematic survey* 54 splenectomized cases in which the diagnoses chronic non-leukemic myeloid splenomegaly can be settled with more or less probability are collected. Some of the cases undoubtedly are of real leukemic origin, and in others the nature cannot be determined with certainty because of lack of information about the bone marrow. These cases are included in the survey in order to illustrate the great risk of splenectomy in all cases of splenomegaly caused by myeloid transformation of the spleen both of non-leukemic and leukemic origin. As HICKLING (1937) was only able to collect 27 splenectomized cases — which are all included in our survey, and among which also some are of leukemic origin — and 21 of our cases were published in 1937 or later, it does not seem superfluous once more to point out the risk of splenectomy in cases in which a myeloid transformation of the spleen cannot be excluded with certainty.

From the survey it is seen that the indication for splenectomy most often has been Banti's disease (15 cases), in 8 cases the indication was mechanical discomfort from the enlarged spleen and in most of these cases X-ray treatment had been tried without effect, in 4 cases the indication was hemolytic jaundice in 4 essential thrombopenic purpura, and in two cases "splenic anemia", in a single case the operation was performed because of splenogenic depression of the bone marrow and in one because of tuberculosis of the spleen. In the rest of the cases (19) the indication for splenectomy is not clear, but in several of them the blood picture showed several myelocytes or nucleated red cells before the operation.

The outlook for the splenectomized patients is undoubtedly very bad. Two of the patients died during the operation, 5 after the operation within 24 hours, 5 between 24 and 48 hours after the operation, 5 between 2 days and 1 week after the operation, 3 between 1 week and 1 month after the operation, 12 between one month and one year after the operation, and 7 between one

and 5 years after operation Ten were alive in good health at the time of the last observation —  $1\frac{1}{2}$  to 8 years after the operation — but two of them (observed after one and seven years) showed pronounced hepatomegaly The remaining 5 were operated upon recently and are still alive, or the fate of the patient is not noted So about 40 per cent of the splenectomized patients die within one month and 60 per cent within one year after the operation, and only in 20—30 per cent is the operation followed by amelioration of the condition of more than one year's duration

The death is in some cases directly ascribable to the very difficult operation — the spleen is often enormously enlarged in this disease — causing hemorrhage, shock, peritonitis or post-operative pneumonia, in other cases it is due to a rapid worsening of the course of the disease, which seems due to the operation (erythroblastic or leukemoid blood crises accompanied by severe anemia resistant to all treatment, severe hemorrhagic diathesis), and in still others the splenectomy seems to have little influence upon the course of the disease, in these cases death occurs some months or years after the operation from causes not differing from the causes of death in cases not operated upon In these cases progressive enlargement of the liver very often takes place, apparently caused by myelopoietic tissue in the liver replacing the lost myelopoiesis of the spleen

As both chronic non-leukemic myeloid splenomegaly and chronic subleukemic or aleukemic myeloid leukosis end fatally in some months to a few years, a postoperative death rate of 40 % within one month is very high even in view of the serious nature of the diseases in question On the other hand, the figures above do not justify the opinion that a splenomegaly due to myeloid transformation of the spleen is an absolute contraindication against splenectomy, for it may be of value in some cases in which the mechanical discomfort caused by the enlarged spleen is so great that life is unbearable to the patient It is, however, to be stressed that splenectomy ought to be carried out in splenomegaly due to myeloid metaplasia only on very narrow indications, treatment with X-rays ought to be tried first, and here it must be remembered that this treatment is by no means without risk in these conditions as it may lead to severe anemia or fatal agranulocytosis even with moderate doses (*cf* WITH, 1944, Case 1, HECHT-JOHANSEN, JOHANSEN & WITH, 1944)

## Measures Necessary to Avoid Splenectomy in Myeloid Splenomegaly.

In order to avoid splenectomy on false indication in cases of splenomegaly due to myeloid metaplasia it is of primary importance not to perform this operation unless the most careful hematological examination has been carried out. Several differential counts with 200—500 cells must be performed, and if immature red or white cells are found, splenectomy must not be carried out unless at least one puncture of the spleen has shown the absence of myeloid transformation.

Sternal puncture must always be performed before splenectomy in such cases, and if it yields uncertain results biopsy of the bone marrow should be made (*e g*, with the CHRISTIANSEN electric drill) in order to exclude myelosclerosis. Further, the osseous system has to be examined by X-rays to exclude osteosclerosis and generalized osseous carcinosis.

The most important method of examination is, however, the *puncture of the spleen*. In its modern form, this method has been developed by ÉMILE-WEIL and his collaborators (WEIL, ISCH-WALL & PERLÈS, Monograph, 1936) and in the hands of the skilful examiner the risk of greater hemorrhage from the spleen is very limited. In Denmark the method has been used with good results by JOHANSEN. It can be said that with the low risk which is now attached to a puncture of the spleen performed *lege artis* it is almost certainly more risky to perform splenectomy without foregoing puncture than to carry out splenic puncture before every such operation, and in cases with immature cells in the peripheral blood splenic puncture absolutely ought to be carried out before operation is decided upon.

As even the apparently most typical cases of Banti's disease, hemolytic jaundice and essential thrombopenic purpura may turn out to be chronic non-leukemic myeloid splenomegaly the only certain way to avoid splenectomy on false indication in these diseases is to perform splenic puncture as a routine examination before the operation.

Table 2.

*Schematic Survey of 54 Cases of Chronic Myeloid*

No	Reference	Age, Sex	Indication for splenectomy	Result of splenectomy	Chief characteristics of blood	
					Before splenectomy	After splenectomy
1	RATHERY, 1902	ca 60 ♂	Not specified	Died in 48 hours	Er 37, Hb % 68 L 41,000 My 133 %, no NR	Not noted
2	HIRSCHFELD, 1905	45 ♂	Banti's disease	Died in 1 hour (hemorrhage)	Er 48 L 8,300—20,600 No differential count	Not noted
3	NAUWERCK & MORITZ, 1905	37 ♀	Not specified	Died in 5 weeks (pneumonia)	Er 36, Hb % 60 L 7,000—11,000 My 47 %, NR 72 %	No major changes except a trans- ient increase in NR (to 46 %)
4	RYCHLIK, 1907	18 ♂	Banti's disease	Died in 24 hours	L 14,300—15,600 My 1—4 %, NR 0—0.5 % Er and Hb % not noted	L 25,600—31,000 No My NR 0— 0.9 %
5	FRAENKEL, 1912	Not no- ted ♂	Not specified (Enormous splenomegaly)	Died in 48 hours	A few NR Details not noted	Numerous NR 1 hour post mor- tem
6	HIRSCHFELD, 1914	64 ♀	Banti's disease	Died in 3 hours (Shock?)	Er 21—29 L 8,900—19,000 My 5 %, NR "many"	Not noted
7	CESA BIANCHI, 1921	50 ♀	Banti's disease	Died in 4 days	Er 40—42, Hb % 65—85 L 8,800—11,800 No My or NR	Not noted
8	BERBLINGER, 1926	39 ♀	Banti's disease	Died in 48 hours (Peritonitis)	Er 37—43, Hb % 62—95 L 4,300—7,300 No My or NR	Not noted
9	FIESSINGER & OLIVIER, 1926	49 ♂	Not specified	Died during the operation	Er 11—24 L 11,000—19,000 My 4—26 %, NR 26—56 %	Not noted
10	GRIVA & AN- GELERI, 1926	50 ♂	Essential thrombopenic purpura	Alive 2 years after the ope- ration	Moderate anemia 15,000 thrombo- cytes No details given	Severe anemia with erythroblas- tosis (NR 12,000 —15,000) of 7 months' duration

*Splenomegaly upon which Splenectomy was Performed*

Chief characteristics of the spleen	Chief characteristics of the bone marrow	Miscellaneous remarks
1,500 g Pronounced myeloid metaplasia (My, Mgl and NR) Preserved follicles in some places	Hyperplasia of all the hematopoietic elements	Lymph nodes, Reticular hyperplasia but no myeloid metaplasia
3,300 g Pronounced myeloid metaplasia with numerous Mgl Histologic details not given	Not noted	Myeloid metaplasia in the lymph nodes similar to that of the spleen
2,020 g Pronounced myeloid metaplasia with many NR and Mgl Histologic details not given	Generalized osteosclerosis with hyperplastic marrow showing preponderance of My and Mgl	Moderate myeloid metaplasia of the liver with many Mgl
25 × 15 × 20 cm Moderate myeloid metaplasia No NR Histologic details not given	Hyperplastic marrow Pronounced osteosclerosis	Splenomegaly, hepatomegaly and jaundice during 9 months
3,700 g Myeloid metaplasia Reduced trabeculae A few follicles preserved Many NR in blood from splenic vein at operation	Pronounced general osteosclerosis Cavity almost obliterated	Myeloid metaplasia of visceral lymph nodes
Pronounced myeloid metaplasia with many NR Atrophy of follicles	Hyperplasia Osteosclerosis in some places	Pronounced myeloid metaplasia of the liver
1,520 g Pronounced myeloid metaplasia Erythropoietic foci Numerous Mgl Only few follicles left	Not noted	No autopsy
2,650 g Pronounced myeloid metaplasia Well preserved follicles NR and Mgl not mentioned	Hyperplasia (right femur)	Slight myeloid metaplasia in the liver and lymph nodes
1,200 g Moderate myeloid metaplasia (My, NR, Mgl) Preserved follicles Moderate fibrosis Areas of hemorrhagic infiltration	Not noted	Slight myeloid metaplasia of the liver (partial autopsy)
Spleen 3—4 times normal size Pronounced myeloid metaplasia Dominating erythropoiesis Details not given	Sternal puncture showed blood of the same composition as that of the peripheral circulation	The condition of the patient practically unchanged after the operation

No	Reference	Age, Sex.	Indication for splenectomy	Result of splenectomy	Chief characteristics of blood	
					Before splenectomy	After splenectomy
11	BALLIN & MORSE, 1927 Case 1	34 ♀	Mechanical inconvenience from the movable spleen	Alive 8 years after the operation in good condition	Er. 3.0—4.5; Hb % 75—85 L. 16,000—24,000 My. 2—4 %; NR 8—17 %	No major changes after the operation
12	BALLIN & MORSE, 1927 Case 2	43 ♂	As Case No. 12	Survived. "Operated upon recently"	As Case No. 12 (11 and 12 described together)	L. 52,000. Otherwise no major changes
13	BÉCARD, 1927	47 ♀	Splenic anemia	Survived. Length of observation not noted	Er. 0.89 L. 4,000 No My. NR 3 %	"Slow regeneration of the blood"
14	GORDON, 1927	Not noted	Not specified	Died in 3 days	L. ca. 12,000 My. "a few"	"High leukocytosis. Many transitional forms of leukocytes and NR"
15	JAFFÉ, 1927 Case 1	51 ♂	Banti's disease	Died in 16 hours	Er. 4.6—3.6; Hb % 89—75 L. 7,600. No My. NR 0—4 %. All leucocytes showed nuclei with 3—4 segments	Not noted
16	JAFFÉ, 1927 Case 2	43 ♂	Essential thrombopenic purpura	Died during the operation	Er. 0.9; Hb % 22 L. 4,300 No My or NR. 30,000 thrombocytes	Not noted
17	ROCH & MOZER, 1927	43 ♂	Banti's disease	Alive 3 years after the operation in good condition	Er. 3.4; Hb % 70 L. 12,400 No My or NR	Postoperative "subleukemic crisis". Later marked thrombocytosis
18	VILLA, 1927	31 ♀	Banti's disease	Alive 7 years after the operation in good condition	Er. 2.0; Hb % 30 L. 5,000 No My or NR	Er. 5.2; Hb % 80 L. 80,000 My 11 % NR 15 % at the end of the observation period
19	DUBINSKAJA, 1928	48 ♀	Not noted	Not noted	Er. 4.3; Hb % 40 L. 23,000 My 5 %; NR "a few"	Not noted

Chief characteristics of the spleen	Chief characteristics of the bone marrow	Miscellaneous remarks
550 g Moderate myeloid metaplasia with preserved follicles, slight fibrosis and scattered Mlgk	Not noted although the article is entitled "Myelophthisic splenomegaly"	
ca 800 g Details as in Case No 11	As Case No 11	
1,000 g Pronounced myeloid metaplasia (My, NR especially) Reticular hyperplasia Splenic structure abolished	Not noted	Probably a case of real leukosis
Not noted	Not noted	Doubtful case Possibly leukosis
2,670 g Pronounced myeloid metaplasia Structure abolished Many erythropoietic foci and Mlgk	Not noted (no autopsy)	Myeloid metaplasia of splenic lymph nodes
1,175 g Myeloid metaplasia with pronounced erythropoiesis	Hyperplastic marrow (apparently only femur examined)	
1,215 g Myeloid metaplasia Atrophy of follicles Histology suggestive of myeloid leukosis	Not noted	L not above 27,400 at any time Jaundice present Thrombophlebitis recidivans after the operation
2,500 g Pronounced myeloid metaplasia (Myeloblasts, My, NR and Mlgk) Atrophy of follicles	Biopsy (tibia) No marrow tissue but blood from the biopsy showed many immature cells	The liver increased in size, was 16 cm below the costal arch after 7 years
3,000 g Pronounced myeloid metaplasia Many Mlgk Some reticular hyperplasia Traces of follicles present	Not noted	

No	Reference	Age, Sex	Indication for splenectomy	Result of splenectomy	Chief characteristics of blood	
					Before splenectomy	After splenectomy
20	PINKERTON, 1929 Case 8	52 ♂	Banti's disease	Died 2½ years after the ope- ration	Er 31, color in dex 1.20 L 5,200 My 4 %, NR 3 %	The first 5 months unchanged After 2½ years L 180,000, My 83 %
21	DOWNNEY, PAL- MER & POWELL 1930	56 ♀	Not specified	Died in 3 months	Er 24—34, Hb % 60 L 1,930—3,300 My 12 %, NR "numerous" Thrombocytes 32,000—42,000	Er 22, Hb % 45 L 10,400 No differential count given
22	MIZON, 1930 (Also pub- lished by GOU- DIER & HOU- CKE, 1930)	48 ♂	Tuberculosis of the spleen	Died in 15 days	Er 42, Hb % 80 L 4,900 No My or NR	Not noted
23	TROISIÈRE & CATTAN, 1932	52 ♀	Hemolytic jaundice	Alive 2 years after the ope- ration in good health	Er ca 10, retic- ulocytes ca 50 % L 20,000 My 0—5 %, NR 100 %	Normal after a month except slight leukocyto- sis
24	FONTANA & PETTINARI, 1933	46 ♂	Banti's disease	Alive one year after the ope- ration	Er 49, Hb % 60 L 7,800 No My or NR	Largely unchang- ed, but 2—3 % NR and many nuclei of Mgh after one year
25	CHENEY, 1934 Case 1	55 ♂	Banti's disease	Died in 10 days	Er 11—38, Hb % 28—60 L 4,000—19,000 My 20—38 %, NR No NR	Not noted
26	FAVRE, CROIZAT & GUICHARD, 1934, Case 1	Not noted ♀	Uncertain diagnosis	Died in 3 days	Normal (not spe- cified)	Slight terminal leukocytosis with myeloid reaction
27	FAVRE, CROIZAT & GUICHARD, 1934, Case 2	55 ♀	Not noted	Alive 3 months after the ope- ration	Er 35—25 Hb % 70—90 L 7,200—8,400 No My, NR sev- eral many	Er 27—20, Hb % 70—80 L 20,400—30,000 No My, NR not noted
28	OLMER & PAIL- LAS, 1935	60 ♂	Splenic anemia	Died in 2 days	Er 31—18, Hb % 70—50 L 7,500—10,800 My 8—10 %, NR 12—13 %	Er 18—26 L 16,400—23,300 My 13—31 %, NR 70—160 %

Chief characteristics of the spleen	Chief characteristics of the bone marrow	Miscellaneous remarks
1,400 g Structure well preserved Myeloid metaplasia with marked erythropoietic activity	Not noted (no autopsy)	Duration of the splenomegaly before the operation 5 years
Fibrosis and reduced follicles Myeloid metaplasia in some regions Numerous Mgc	Not noted	The liver showed many Mgc, NR and myeloblasts in the sinusoids
3,330 g Fibrosis and reticulosis Follicles small but present Myeloid metaplasia of pulp with numerous Mgc	Hyperplasia of myeloid series with many Mgc (tibia)	No myeloid infiltration in the liver
1,335 g Follicles atrophic but still visible Myeloid metaplasia (especially NR) Hemorrhagic infiltration of pulp	Not noted	Pronounced amelioration after splenectomy Red cell fragility 0.80—0.45 % NaCl
1,200 g Pronounced myeloid metaplasia (mainly NR) Traces of follicles Some Mgc Moderate hyperplasia of the reticulum	Puncture of sternum and tibia showed normal myelograms	Hepatomegaly present at the end of the observation period
2,000 g Marked myeloid metaplasia with a great variety of cells	Extensive irregular infiltration of myeloid type (fe mur)	Myeloid infiltration in the liver sinusoids Ascites A history of jaundice
Total diffuse myeloid metaplasia including some NR and Mgc Small but visible follicles Well marked reticular hyperplasia	Not noted	Myeloid metaplasia of visceral lymph nodes Scattered hematopoietic foci in the liver sinusoids
1,600 g Follicles well preserved Scattered areas of marked myeloid metaplasia with many NR and Mgc	Not noted	Slight myeloid metaplasia in liver sinusoids with many Mgc
Marked reticular hyperplasia and myeloid infiltration (in sinuses) with some Mgc Follicles not noted	Not noted	

No	Reference	Age, Sex	Indication for splenectomy	Result of splenectomy	Chief characteristics of blood	
					Before splenectomy	After splenectomy
29	McMICHAEL & McNEE, 1936 Case 1	66 ♀	Mechanical an- noyance from the enormous \ ray resistant spleen	Died in 2 days	Er ca 50, Hb % ca 90 L 8,400—21,300 My 9—25 %, NR 0—7 %	Not noted
30	McMICHAEL & McNEE, 1936 Case 2	30 ♀	As Case 29	Died in 3 years	Er 42—25, Hb % 68—44 L 28,000—7,660 (2,500) My 5—1 %, NR 3—1/2 %	Er 16—62, Hb % 32—86 L 15,000—58,000 My 0—8 %, NR 45—265 %
31	McMICHAEL & McNEE, 1936 Case 3	60 ♀	As Case 29	Died in 1 1/2 years (cerebral injury)	Er 50—52, Hb % 80—72 L 10,000—36,000 My 0—3 %, NR 5 %	My 9 %, NR 8 % Details not noted
32	THOMPSON, 1936, Case 32	27 ♂	Hemolytic jaundice	Died in 1 year	Er 0.94, Hb % 20 L 31,200 Reticulocytes 19 %	Not noted
33	THOMPSON, 1936, Case 33	63 ♂	Hemolytic jaundice	Died in 1 month	Er 1.3, Hb % 35 L 3,300 Reticulocytes 37 %	Not noted
34	DUIVOIR <i>et al</i> , 1937 & 1941	22 ♀	Not specified	Died in 3 1/4 years	Er 3.4, Hb % 80 L 6,000 No My, NR 2 %	Er 2.0—3.5, Hb % 70—85 L 14,000—54,800 My 1—10 %, NR 1—30 %
35	FLORENTIN <i>et</i> <i>al</i> , 1937	16 ♀	Banti's disease	Died in 2 months	Er 4.1—2.0, Hb % 62—37 L 4,100—1,400 No My or NR	Er 2.8—3.3, Hb % 40—47 L 9,600—26,000 No My, NR 0— 2 %
36	METTIER & RUSK, 1937, Case 1	40 ♀	Not specified	Died in 3 months	Er 2.1, Hb % 43 L 4,200, My 43 %, NR "a sin gle", 10,000 thrombocytes	Er 2.40, Hb % 34 L 25,900, My 5: % NR not noted increase of plate lets (to 100,000
37	SCHMENGLER & KRAUSE, 1937, Case 4	20 ♂	Splenogenic de pression of the marrow	Died in 1 year	Er ca 2.0, Hb % ca 40 L 3,300—4,800 No My or NR Thrombocytes 60,000	Er and Hb % un changed L in creased and reached 25,00 with 20 % My NR present

Chief characteristics of the spleen	Chief characteristics of the bone marrow	Miscellaneous remarks
2,550 g Pronounced myeloid infiltration Numerous NR and Mlgk Follicles not noted	Normal, active marrow in ribs, fat marrow in femur	Pronounced hepatomegaly due to myeloid infiltration in sinusoids
4,300 g Microscopic picture largely as in Case 29	Not noted	Temporary improvement after splenectomy Progressive hepatomegaly
1,970 g Structure abolished Massive myeloid infiltration (Stem cells, myeloblasts and NR)	Not noted	Improvement after splenectomy of more than one year's duration
'Marked blood formation' Details, not noted	Not noted	
As Case 32	Not noted	
1,200 g Structure preserved Myeloid metaplasia with many NR and occasional Mlgk	Normal active marrow (sternal puncture)	Postoperative thrombocytosis (up to 4 millions), but in spite of this hemorrhagic diathesis
1,600 g Fibrosis and reduction of follicles Myeloid infiltration of pulp (mainly Mlgk, no NR)	Not noted	
Myeloid metaplasia without erythropoiesis	Myelofibrosis and slight osteosclerosis (femur and ribs)	Myeloid metaplasia in the lymph nodes but not in the liver
1,200 g Histologic picture like a leukemic spleen Details not given	Not noted	Liver increased enormously after the operation Operated upon after the advice of NAEGLI

No	Reference	Age, Sex	Indication for splenectomy	Result of splenectomy	Chief characteristics of blood	
					Before splenectomy	After splenectomy
38	ÉMILE WEIL, CHEVALLIER & SÉE, 1938	58 ♂	Banti's disease	Died in 24 hours	Er 50, Hb % 70 L 22,000 No My or NR	Not noted
39	ÉMILE WEIL, ISCH-WALL & PERLS, 1938	54 ♂	Enormous X ray resistant splenomegaly	Died in 1½ year	Er 25—40, Hb % 70—80 L 18,600 (1,200— 7,100) My 24—27 %, NR 23—6 %	Erythroblastic cri- sis (NR 60 %), thrombopenia (30,000) but no other major changes
40	KLEMPERER, 1938, Case 1	12 ♀	Essential thrombopenic purpura	Died in 3 months	No immature cells	Not noted
41	KLEMPERER, 1938, Case 2	"Child" Not noted	As Case 40	Died shortly after operation	As Case 40	"Leukemic blood picture"
42	LINDEBOOM, 1938, Case 1	49 ♀	Mechanical dis- comfort caused by the spleen	Alive 1 year af- ter the opera- tion	Er 42—50, Hb % 65—80 L 3,000—12,500 My 2 %, NR 2— 10 %	Er 25, Hb % 50 L and My largely unchanged, NR 130—70—15 %
43	WAITZ & WAR- TER, 1938	33 ♂	Not specified	Died in 6 months (from choolangitis)	Er 35—47, Hb % 80—72 L 7,000—3,000 My 1—5 %, NR 5—1 %	Er 42, Hb % 70 L 18,000 No My, NR not noted
44	DOWNER & NORLAND, 1939	56 ♀	Not specified	Died in 3 months	Hb % 43, Er not noted L 22,000 My 1 %, Myeloblasts 24 %, NR 155 %	Er 27, Hb % 38 L 4200, numer- ous Mgl in blood, 10 days after the operation
45	JACKSON <i>et al</i> , 1940, Case 1	63 ♀	Hemolytic jaundice	Died in 3 days	Er 0.82, Hb % 20 L 27,000, My 2 % NR not noted Reticulocytes 38 %	Not noted
46	JACKSON <i>et al</i> , 1940, Case 6	30 ♀	Not specified	Died in 1½ year (from pyemia)	Er 32—41, Hb % 60 L 7,000—53,000 My 3 %, NR 5 %	No major changes
47	JACKSON <i>et al</i> , 1940, Case 8	22 ♂	Not specified	Died in 5 months	Er 39—45, Hb % 84—110 L 12,000—40,000 with many im- mature forms	Er 30 L 70,000 My 3 %, a single NR

No	Reference	Age, Sex	Indication for splenectomy	Result of splenectomy	Chief characteristics of blood	
					Before splenectomy	After splenectomy
48	KJERULI JENSEN, 1940, Case 1	55 ♀	Banti's disease	Alive 2 years after the operation	Er 35, Hb % 49 L 7,600 No My or NR	Er 36—54, Hb % 51—94 L 7,720—22,000 My 0—2 %, Mgl 1 % NR 1 % leucocytes — 100 % Thrombocytes 342,000— 1,200,000
49	KJERULI JENSEN, 1940, Case 2	64 ♀	Not specified	Alive 2 years after the operation	Hb % 60 L 15,000 No My or NR	Er 28—35, Hb % 55—68 L 15,000—20,000 My 1—3 %, Mgl 1—2 % NR 8— 32 %, Thrombo- cytes 316,000— 5,000,000
50	CARLSTER & FLORA, 1941	33 ♂	Not specified	Died in 3 years	Er 243 L 3,100 My 4 %, Mgl 5 % % NR 9 %	Er 23—31, —11 L increased and reached 80,000, then decreased to 2,600 My 1—11 % Mgl 3—25 % NR 7— 54 %
51	DI GUGLIELMO & QUATTRINI, 1942	12 ♀	Not specified	Died in 7 months	Er 10—15, Hb % 20—32, L 15,500 NR 80 % My 0—1 %	Er 20—37, Hb % 42—62 L 10,000—17,000 NR decreased to 1 %, My 0—1 %
52	BUKH & WITH, 1943 (own Case)	48 ♂	Banti's disease	Died in 7 months	Hb % 100 White blood pic- ture normal (No details available)	Progressive ane- mia (to Hb % 30) L ca 35,000, My 0—0.5 % NR 0—15 %
53	HITTMAYER, 1944, Case 1	43 ♀	Not specified	Died in 1 year	Not noted	24 hours after the operation myelo- blasts and 12 % NR 10 % My L 19,000—31,000
54	HITTMAYER, 1944, Case 2	54 ♂	As X-rays were without effect splenectomy was tried	Operated upon recently	1938, Slight ane- mia L 1,600, My 18 % NR 9 % 1941 Lr 32— 43, L 25,000, Mgl 5—6 %	Not noted

Abbreviations used in the survey: My = myelocytes NR = nucleated red cells (number per 10<sup>6</sup>)  
Hb % = hemoglobin percentage

Chief characteristics of the spleen	Chief characteristics of the bone marrow	Miscellaneous remarks
1,850 g Chronic hyperplasia with some myeloid infiltration (NR and Mgl) Several degenerated to necrotic areas	Sternal puncture showed the same differential count as the blood	No hepatomegaly in the observation period Apparently amelioration after the splenectomy
1,330 g Chronic hyperplasia with slight myeloid metaplasia and reticular hyperplasia	Not noted	Moderate enlargement of the liver
3,000 g Violent myeloid infiltration of pulp with many NR and Mgl	Myelofibrosis (sternum, ribs, vertebrae, femur) Slight osteosclerosis	No myeloid metaplasia of the liver and lymph nodes Cause of death military tuberculosis
Pronounced erythropoiesis Histologic details not noted	The proportion white/red immature cells in the sternal marrow 0.11—0.16	Erythropoiesis in liver and lymph nodes (biopsy)
1,250 g Myeloid metaplasia (My and NR) Reticular hyperplasia Preserved follicles	General osteosclerosis (X-ray) Hyperplastic marrow of normal composition (sternum at autopsy)	Myeloid infiltration in the liver sinusoids
2,100 g Pronounced reticular hyperplasia and myeloid metaplasia Many Mgl	3 sternal punctures showed peripheral blood with occasional congregations of nuclei of Mgl	Liver puncture Slight myelopoiesis
5,000 g Myeloid metaplasia Numerous Mgl Preserved follicles	Sternal puncture Peripheral blood X-ray Pronounced osteosclerosis	Liver biopsy Some Mgl but otherwise no myeloid metaplasia

(leukocytes), Mgl = megakaryocytes, L = number of leukocytes, E<sub>1</sub> = number of erythrocytes,

### Summary.

The disease chronic non-leukemic myeloid splenomegaly is briefly described, and a personal case in which splenectomy was performed is presented. The risk of performing splenectomy on false indication in this disease is stressed and a survey of 54 cases of chronic non-leukemic myeloid splenomegaly from the literature in which splenectomy was performed is given. As the issue of the operation in these cases very often is fatal and seldom of real benefit to the patient, splenectomy in this disease ought only to be carried out on certain narrow indications described. To avoid splenectomy on false indication splenic puncture is necessary, and it may be carried out with very small risks with the technique of ÉMILE-WEIL and collaborators. In all — even apparently typical — cases of BANTI's disease, hemolytic jaundice and essential thrombopenic purpura, splenic puncture has to be carried out before splenectomy is decided upon.

### Zusammenfassung.

Die Krankheit chronische nicht-leukämische myeloische Splenomegalie wird kurz beschrieben und ein eigener Fall, bei dem Splenektomie vorgenommen wurde, vorgelegt. Es wird die Gefahr betont, bei dieser Krankheit auf falsche Indikation hin eine Splenektomie vorzunehmen, und eine Übersicht gegeben über 54 im Schrifttum vorkommende Fälle von chronischer nicht-leukämischer myeloischer Splenomegalie, bei denen Splenektomie vorgenommen wurde. Da der Ausgang der Operation bei diesen Fällen oft ein tödlicher ist, und der Eingriff für den Kranken selten einen wirklichen Vorteil bedeutet, soll die Splenektomie bei dieser Krankheit nur auf gewisse eng begrenzte Indikationen hin vorgenommen werden, die beschrieben werden. Zur Vermeidung einer Splenektomie auf falsche Indikationen hin ist eine Milzpunktion erforderlich, und diese lässt sich mit der Technik von Émile-Weil und Mitarbeitern mit sehr geringer Gefahr durchführen. Bei allen — selbst bei anscheinend typischen — Fällen von Morbus Banti, hämolytischem Ikterus und essentieller thrombopenischer Purpura muss die Milzpunktion vorgenommen werden, ehe man sich zu einer Splenektomie entschliesst.

## Résumé.

Les auteurs décrivent brièvement la splénomégalie chronique myéloïde non-leucémique et présentent un cas personnel traité par splénectomie. Ils mentionnent les risques que comportent la splénectomie pratiquée sur une fausse indication et passent en revue 54 cas de splénomégalie chronique myéloïde non-leucémique trouvés dans la littérature et dans lesquels on a pratiqué la splénectomie. Comme l'issue de l'opération de ces cas est généralement fatale et apporte rarement un bénéfice réel au malade, la splénectomie ne doit être pratiquée dans cette affection que sur des indications nettement délimitées que l'auteur expose. Pour éviter la splénectomie sur fausse indication, la ponction de la rate est nécessaire, on peut la pratiquer avec des risques très réduits en recourant à la technique d'Émile-Weil et de ses collaborateurs. Dans tous les cas, même lorsqu'ils paraissent typiques, de maladie de Banti, d'ictère hémolytique et de purpura essentiel thrombopénique, il faut recourir à la ponction splénique avant de décider la splénectomie.

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## Has Acute Haematogenous Osteomyelitis Become Less Common and Less Severe?

By

GOSTA JONSSON

In 1853 the French surgeon CHASSAIGNAC launched the term acute haematogenous osteomyelitis, and since that time the pathogenesis, clinical course and treatment of this disease have at times been very widely discussed by surgeons

During the last ten-year period in particular, several surgeons have advanced the suggestion and had the impression that the disease has latterly changed its character in so far as it has with time occurred in less severe forms and, at the same time, less frequently among the surgical clientele

In 1938 J LEHMANN in Rostock suggested that the acute osteomyelitis of recent years is a considerably milder type, and that in some cases it is even difficult to distinguish it from tuberculous bone changes According to LEHMANN the course of the disease is milder and more lingering than previously

The geographical occurrence of the disease has been closely discussed The German surgeon BUZZELLO claims to have found that the disease is more serious on the coast of the Baltic and in Greifswald than elsewhere LAWEN holds that he has seen more serious cases in Leipzig and Marburg than in Königsberg

At the time before and after the first world war W MÜLLER made the same observation as BUZZELLO, *i e* that the cases on the Baltic coast were markedly more serious than the cases in the interior of the country

WAKELY has the impression that the disease is diminishing in frequency due to the active attitude of recent years to therapy against focal infections, and to the improved general hygiene

Seasonal variations have also been observed. TRICHY had the impression from the Marburg Clinic that most cases occur during spring and autumn, while there are fewer cases during summer and winter.

To contribute, if possible, to this discussion of variations in the degree of severity and in the frequency of this disease, the cases of acute osteomyelitis from the Surgical clinic in Lund have been gone through. The material, collected from the years 1912—1941, may be considered to represent a fairly unchanged area of admittance, as the clinic in Lund, by localization and in its capacity of University clinic, can be looked upon as the centre of a fairly unchanging clientele from the Scanian countryside in particular. And further, all the cases have been treated on the same lines during these thirty years, and the former chief of the clinic, Professor G. PLTRÉN has superintended the treatment of nearly every single case. In almost all cases this treatment has been operative, and consisted in chiselling of the medullary cavity or in incision of an abscess. No case has been treated with serum or chemotherapeutics.

The Lund clinic's position as medical centre in southern Scania (with the exception of Malmö) is proved by the fact that no less than 34 of the cases treated at the clinic for acute osteomyelitis have returned to the clinic with recurrences. This figure was obtained from the journals and no after-examination of the material was necessary.

A careful after-examination would, no doubt, yield a number of interesting data regarding the late results of so homogeneous a material as the present, but this has owing to certain circumstances, as yet been impossible, nor does it come within the province of the present study.

During these thirty years 135 patients with acute haematogenous osteomyelitis have been treated at the Surgical clinic. 20 of these 135 patients died from their original disease during their stay in the clinic.

The distribution on sex and age corresponds to that found by most authors. There is thus a prevalence of male cases — 89 (66 %) of the 135 cases were male and 46 (34 %) female. As to the distribution of age the peak is found at 12 years in the Lund material.

63 and 68 cases respectively have occurred during the first and second decennium of life, and only 4 cases after this time. See

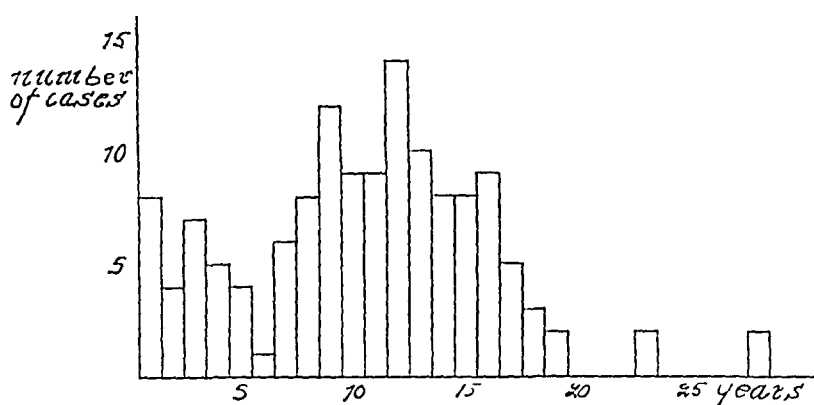


Fig 1 Distribution of age

figure 1 Expressed in per cent there are 46.6 % during the first decennium and 50.3 % during the second

In the 135 cases the disease was localized as follows

Femur	53 (36 %)
Tibia	54 (36 %)
Humerus	18 (12 %)
Fibula	5
Radius	2
Ulna	3
Clavicle	3
Metacarpal-metatarsal	2
Pelvis	4
Calcaneus	3
Talus	1

135 cases with 148 foci

These figures agree well with those found by other investigators. In a Finnish statistical study from 1924 HEINONEN gives the following percentages

Femur	41 %
Tibia	36 %
Humerus	9 %

and THOMSEN in a Danish report from the years 1931—1938

Femur	30 %
Tibia	36 %
Humerus	8 %

In the 20 patients who died from the disease the process was in

8	instances	localized	to	the	femur
7	»	»	»	»	tibia
1	»	»	»	»	humerus
1	»	»	»	»	talus
2	»	»	»	»	pelvis
1	»	»	»	»	radius

In the table below the patients admitted and treated during these thirty years are registered in periods of five years, the number of deaths within each five-year period is also given

Table I.

*The 135 cases divided into five-year periods*

	1912-16	1917-21	1922-26	1927-31	1932-36	1937-41
Men	17 (3)	20 (4)	16 (3)	12 (1)	12 (2)	12 (0)
Women	9 (1)	11 (1)	6 (0)	7 (3)	10 (2)	3 (0)
Number of cases	26 (4)	31 (5)	22 (3)	19 (4)	22 (4)	15 (0)

Figures in brackets denote the number of deaths

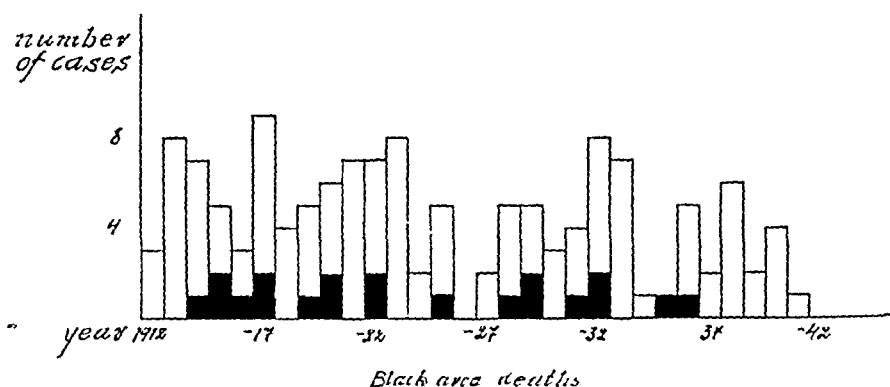


Fig 2 Number of cases per year from 1912—1941

As is seen from the table there was no death during the last five-year period, while on the other hand the number of deaths during the 5 earlier five-year periods is nearly constant — about 1 6

The greatest number of admitted and treated patients is found during the second five-year period, 31 cases, and the lowest, 15 cases, during the last five-year period

The figures in table 1 are not sufficiently high to allow of any certain conclusions as to the decrease in frequency and mortality. They illustrate and stress, however, the observations advanced by others, viz that acute osteomyelitis seems to be a disease which not only diminishes in frequency but which nowadays also seems to appear in a milder form with lower mortality.

Our view of this disease is still based on the fundamental studies and experiments by LEXER and his pupils on the pathogenesis of acute haematogenous osteomyelitis. The theory of embolism of LEXER and his pupils, which has also been verified experimentally, shows that the metaphyseal arteries are, from a functional point of view, terminal arteries. Consequently there are great possibilities for the formation of infarction necrosis, which is a suitable soil for bacterial agents, brought to the metaphysis. For an osteomyelitis to set in, it is necessary that the disease-eliciting bacteria are sown haematogenously from a definite place of entrance. Moreover, these patients not infrequently show an infected wound, a furuncle, a pyoderma, a felon, an angina, or the like.

When admitted to the clinic 25 of the patients in the Lund material had some probable or possible place of entrance in the form of a furuncle, a felon or an infected wound. In 5 of the cases there was an existing or recently healed angina or some other catarrhal infection.

TICHY's suggestion and impression that the disease is more frequent during spring and autumn when the catarrhal infections are most frequent, is not borne out by the Lund material.

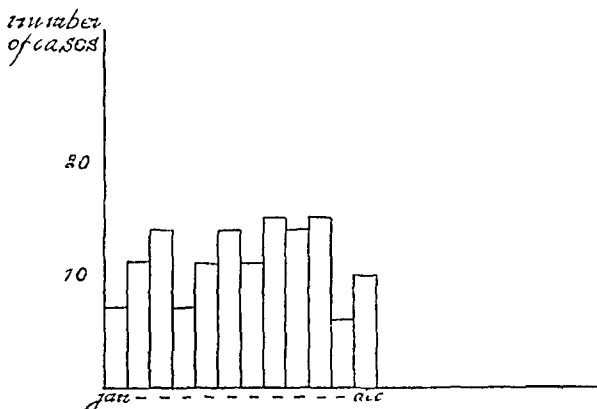


Fig 3 The cases distributed over the different seasons

The cases are shown to be fairly equally distributed over various months and seasons. It is perhaps possible to observe a slightly

lower frequency during the winter months, and this might possibly be due to the fact that the children are exposed to fewer scratches and grazes during this time than during other seasons, when they work and play out-of-doors and are much more liable to get infected skins wounds.

In 18 of the 135 cases a previous trauma due to a blunt agency has been recorded at the site of the osteomyelitis. The part played by such a trauma in causing acute haematogenous osteomyelitis is a very important question, especially from the point of view of insurances.

The general opinion is, however, that blunt violence alone is exceedingly seldom, if ever, to blame for the osteomyelitis. When obtaining the anamnestic data from a growing boy or girl there is never the least difficulty in proving earlier violence to the affected part, especially when we know how easily the layman can connect up a trauma with a later disease.

In a closer study of the journals for the general condition and appearance of the patients on admittance, such expressions as "very poor", "septic", "greatly affected", etc. occur much more often during the first five-year periods. I had on the whole the general impression that the patients were much more affected and in a worse state during the earliest five-year periods than later. During the last five-year period it has been noted in only three cases that the patients have been affected, while in 11 and 15 cases of the first two five-year periods respectively it is said that the patients were in a very bad condition and greatly affected when admitted.

If any conclusions as to the degree of severity of the disease are to be drawn from the condition of the patients on admittance, it is necessary that the time between their contracting the disease and their admittance to hospital corresponds in the various cases. As is seen from the table below the time between the onset of the disease and the admittance to hospital corresponds almost exactly.

The variation amounts to 2.1 days at most. The figures for each separate patient lie very close to the mean, and only one, or in one group two, cases deviate to any great degree from the mean figure. Thus the treatment has not begun earlier during the latter five-year periods than during the earlier.

There remains, then, the impression from the last years that the Lund cases when admitted to hospital are in a better general condition and less affected or toxic than during earlier years.

Table II.

*Mean time of treatment in days and time between onset of disease and admittance to the clinic during each five-year period*

	1912-16	1917-21	1922-26	1927-31	1932-36	1937-41
Mean time in days between onset of disease and admittance	6.5	7	7.2	6.8	5.1	5.1
Time of treatment	227	183	184	203	192	118

To a certain extent we may also be justified in using the time of treatment of the patients to express the degree of severity and course of healing of the disease, always assuming, of course, that the treatment has proceeded along the same lines in all cases.

Naturally the time of treatment depends on more factors than the course of the disease. The distance from the hospital, the possibilities of applying dressings at home, and the development of communication all play a certain rôle, but none of these factors can quite explain away the fact that the time of treatment has diminished considerably during the last five-year period.

As regards the Lund material, the figures for the time of treatment indicate with a certain probability that the degree of severity of the disease is considerably less during the last five-year period than during the preceding periods.

The table below records the most common forms of complications which may appear during the acute stage of the disease.

1 *Joint complications.* Two forms are taken into account: symptomatic synovitis and pyarthrosis. The former type is most often less severe, and generally subsides without any special therapy. The latter form, on the other hand, is considerably more serious and demands its special therapy in the form of puncture or arthrotomies. As seen from the table below this type has appeared less and less often during latter years, and in the last five-year period only in one single case.

The arthrotomies with drainage of the joint which were performed so often during earlier years led in nearly all cases to complete stiffness in the engaged joint.

2 *The formation of sequestra.* must probably be considered an almost normal complication during the course of healing. Table 3 registers the number of sequestra which have led to sequestrotomy.

Table III.

*Complications in the form of joint changes and sequestration during each five-year period*

	1912-16	1917-21	1922-26	1927-31	1932-36	1937-41
Number of cases	26	31	22	19	22	15
Joint changes (pyarthroses)	7	9	6	3	3	1
Sequestrations which have led to sequestrotomy	16	13	6	9	9	3

As was the case with the pyarthroses these have also shown a tendency to diminish in number. The presence of a sequestrum often causes a very protracted suppuration from the fistulas which lead in towards the sequestrum cavity. This suppuration does not cease until the sequestrum is removed. LOHR claims that he has in several cases succeeded by his method of treatment in getting the sequestra to heal, thus saving the patients a long fistulous period, when some other complications are a secondary menace, viz eczema, erysipelas, furunculosis and chronic intoxication, which may cause an amyloid degeneration in the parenchymatous organs.

3 As further complications, though less common, may be mentioned the *spontaneous fractures*, the *epiphyseal dislocations* and the *haemorrhages*. These have occurred in 4 cases in the Lund material: 2 haemorrhages and 2 spontaneous fractures. The number of epiphyseal dislocations is not registered precisely enough to give any exact figure.

It is evident that in the Lund material the number of complications as regards pyarthrosis and formations of sequestra has diminished quite considerably during the later five-year periods.

LEHMANN, in Rostock, also gathers from his material that the penetrations into the joint are less common now than formerly. It is quite clear that this fact may influence the length of the time of treatment, as both pyarthrosis and the formation of sequestra with its fistulae considerably prolong the course of the disease.

In view of what has been said above, there seem to be certain reasons to suppose that acute osteomyelitis during later years is

less severe in its course than formerly. A form of complication may perhaps be seen in the multiple occurrence of several osteomyelitic foci and the presence of septic metastases. It is probably impossible, however, to settle in the individual case if the various foci are due to the same primary haematogenous infection or if they are to be considered as metastases from the first osteomyelitic focus, even if the former alternative seems to be the more probable.

The treatment of the 135 cases in the Lund material has consisted in:

Chiselling 96 cases, incision + boring 2 cases, incision of abscess only, 35 cases, and conservative treatment, 2 cases. In 6 of the incised cases chiselling has been performed later on.

From the discussion regarding the advantages of one form of treatment over the other may be quoted the pronouncement of professor A. LÄWEN at the German Surgical Congress in 1939. He said: Of 97 authors who have written on the treatment of acute osteomyelitis during the last 25 years 34 are of the opinion that chiselling with concurrent removal of the bone marrow should be done, 9 advocate chiselling without removal, 9 think that chiselling should only be resorted to in more serious cases, 8 prefer boring only, and 38 do nothing but incise the subperiosteal abscess.

This gives us a good idea as to the variation of opinions regarding the operative treatment of acute osteomyelitis.

In the Lund material the form of treatment used has been directed towards giving the most suitable and rational treatment in each individual case.

In the cases where the disease has been so far advanced that there was a certain formation of an abscess, the only measure has often been incision of the abscess. In the generally less advanced cases, where the abscess has not been found to be circumscribed, chiselling and evacuation of the medullary cavity have as a rule been made. If the patient has been admitted in a pronouncedly acute septic condition, measures of any kind whatsoever have had little influence on the poor prognosis. In such cases neither operative form of treatment is any good, as the local bone focus represents only part of a general septicopyemia.

Most statistical studies give a mortality of 10—30 %. In the Lund material the mortality is 15 %. The treatment methods employed during the different five-year periods are found in the table below.

Table IV.

*Methods of treatment during the various five-year periods*

	1912-16	1917-21	1922-26	1927-31	1932-36	1936-41
Chiselling	23	21	15	13	15	9
Incision	3	10	6	6	7	5
Conservative treatment			1			1

Thus no special method of treatment has prevailed during any one period

With this treatment of the cases the course has as a rule been the following if the patients have not died during the septic initial stage, their temperature has fallen to normal after very varying intervals. In some single cases the temperature has returned to normal as early as a couple of days after operation, in other cases not until some months later. In many cases the patient has passed into a stage of fistulae with prolonged suppuration and recurring fever bouts due to retention of pus. During later years we find, however, that the patients' temperature has returned to normal considerably sooner, that they have less often had fever bouts due to sequestra or to pyemic metastases, and that they have returned to good general condition much sooner than during earlier years.

When studying the Lund material we get the very clear impression that the disease has, during latter years, had a considerably more benign course than formerly with fewer deaths in the septic initial stage, with less complications in the after-course and with a more rapid course of healing.

The reasons for these changes cannot be proved on the basis of the present material. We may, of course, allow for a changed virulence of the bacteria, but it seems more natural to suppose that an improved state of nutrition, improved hygiene — both in general and personal —, a greater amount of vitamins in the food etc. has strengthened the power of resistance of the human organism. A combination of these factors may be a possible reason, too. It is certain that the disease is more often contracted by those badly off than by those more fortunately situated. As yet we are forced to be satisfied with hypotheses when trying to explain the change which seems to have taken place during latter years in this disease, so well known as to its pathological appearance and its course.



Standpunkt einheitlich behandelt wurde, weist auch eine geringere Anzahl von Komplikationen unter der letzten 5-Jahrperiode als unter den fruheren auf. Die Behandlungszeit ist auch bedeutend kurzer unter den letzten Jahren. Der Zustand der Patienten war bei Ankunft in der Klinik auch in den letzten Jahren bedeutlich besser als vorher. Behandlung war in fast allen Fallen operativ (Aufmeisslung und Incision). Vaccin- und Chemotherapie wurde in keinem Fall angewandt. Bei Durchsicht des Materiales von Lund bekommt man also klar den Eindruck, dass die Krankheit unter den letzten Jahren einen bedeutend benigneren Verlauf hat als fruher mit weniger Todesfallen im septischen Anfangsstadium, mit einem mehr komplikationsfreien Nachverlauf und mit einem schnelleren Heilungsprozess.

### Résumé.

Comme suite à la supposition émise, plus particulièrement au cours des dix dernières années, que l'ostéomyélite hématogène aigue avait change de caractère, en ce sens qu'elle aurait diminué de gravité en même temps qu'elle serait devenue moins fréquente, l'auteur a été conduit à examiner l'ensemble des cas cliniques d'ostéomyélite hématogène aigue observé à la clinique chirurgicale de Lund pendant une période de trente années (1912—1941).

L'ensemble de ces cas cliniques englobe 135 observations. La repartition suivant le sexe et l'âge est en accord avec les chiffres habituels.

L'ensemble de ces observations, divisé en périodes de cinq années, montre que c'est au cours de la dernière période que le plus petit nombre de cas a été enregistré, et qu'aucun décès n'a eu lieu pendant cette même période. L'ensemble de ces cas, traité d'une manière uniforme au point de vue thérapeutique, montre également un nombre moindre de complications au cours de la dernière période quinquennale qu'au cours de la première. La période de traitement s'est également montrée sensiblement plus courte pendant les dernières années. L'état des malades au cours de leur entrée à la clinique s'est également montré sensiblement meilleur au cours des dernières années.

Le traitement a pour ainsi dire dans la plupart des cas été opératoire. Il n'a jamais été employé de vaccin ni de chimiothérapie.

L'examen de l'ensemble des cas cliniques observé à Lund donne donc clairement l'impression qu'au cours des dernières années la

maladie a pris une évolution sensiblement plus bénigne qu'auparavant avec un moindre nombre de décès dans la phase de début, et une évolution ultérieure offrant moins de complications ainsi qu'une durée de guérison plus courte

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From the Hospital of Ålesund  
(Medical superintendent H FROSTAD)

## Urinary Stasis and Pains after Cystoscopy with Catheterization of Ureters.

By

H FROSTAD

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At the Hospital of Ålesund a series of clinical and roentgenological studies of ureters after cystoscopy with uretary catheterization has been made. Particularly of such cases which complain of pains after the examination.

The examination of the kidneys and the upper ureters has been made after the common principles. After the general examination intravenous pyelography has first been made. If it then was considered necessary cystoscopy with uretary catheterization was undertaken immediately afterwards. Not very often was it found necessary to undertake retrograde pyelography on one or both sides.

After uretary catheterization it occurs quite frequently that the patients complain of pains and that the urine from one or both ureters, during the examination, was more or less mixed with blood. In such cases renewed intravenous pyelography was made several times, and it was possible to indicate a characteristic urinary stasis on the affected side. The urine was systematically examined, and blood clots have in many cases been found after the pains had disappeared. During the attacks of pain renewed cystoscopy was sometimes made, by means of which it was occasionally possible to point out a blood clot, which stuck out of the ureteral opening on the same side as the urinary stasis. In 3 cases the blood clot was removed and the pains disappeared immediately.

As it appears from the tables below, in all 95 cases have been examined since 1938. To be able to exclude, if possible, the formations of concrements as the cause of the pains no cases of urinary

stasis are included in this series of examinations, or demonstrable concrement in the kidneys or ureters by the first intravenous pyelography. Cases with previous clinical indication of concretions in ureters are also excluded. Neither are cases included where retrograde pyelography was made to exclude complications such as anuria on account of the irritation of the contrast substance on the kidneys by an eventual pyelovenous reflux, as mentioned by ANDREU. The renal function has been determined by urea clearance and "test" nitrogen determination after YVONS' method, and a case with reduced renal function is not included.

No consideration has here been taken to the frequent expanding or smarting pains situated in the very bladder region or in the urinary tract, especially in male patients. The pains dealt with in this work, are less frequent and are usually to be found in the lumbar region or farther down corresponding to the course of the ureter. The pains may be rather sharp, are felt like a pressure, but as a rule never equal, in intensity, those caused by an attack of ureteral stone. Nor have they the typical character of ureteral stone with radiation downwards to penis and testis on the same side. They may be easily overlooked and not attended to because they are not very intense and disappear within a short time. One is often reminded of them by the nurse who appears asking "Cystoscopical patient has such pains since noon, can I give him something. Usually he gets one or two novocain-tablets or 10—15 drops of morphine, which is sufficient.

The pains often start in the lumbar region on one or both sides and in the course of two or three hours gradually spread downwards corresponding to the course of the ureter until they reach inguen where they then discontinue. They may also originate in fossa iliaca, or inguen and remain there as long as they last. The pains may vary in intensity in intervals corresponding to the ureteral peristaltic, or with longer intervals indicative of variability in the intensity of the stasis. Most frequently, however, they are constant. The pains very seldom begin quite suddenly, as is the case in ureteral stone, but usually begin in a slightly increasing movement and decrease likewise. Sometimes, however, they may stop rather abruptly.

As will be seen from table I, 33 of the 95 examined patients had pains after the ureteral catheterization 15 rightside, 14 leftside and 4 on both sides. In most cases the pains appear a few hours after the examination is finished and continue for a short

33 cases with pains and urinary stasis after retraction of the uretary catheters

Number	Sex	Age	Intravenous pyelography	Blood in urine by ure- tary cathete- rization		Condition of pairs after retraction of the uretary catheters		Intravenous pyelography after uretary catheterization with or without pains	Renewed cystos- copy during attack of pains Delivering of blood clots in urine	Diagnosis
				R side	L side	R side	L side			
1	M	29	<sup>18/11</sup> 38 Stasis — Concrem —	++	++	2 hours after wards pains for 1½ hours	2 hours after wards pains for 2½ hours	<sup>18/11</sup> 38 Stasis for 2½ hours on r and l side	Blood clots in urine	Tbc renis bilat
2	F	78	<sup>30/11</sup> 39 Stasis — Concrem —	—	+	—	1½ hour after wards pains for 1½ hours	<sup>1/12</sup> 39 Stasis for 2 hours on l side	Urine not ex- aminad	Tbc renis dext
3	M	19	<sup>21/7</sup> 39 Stasis — Concrem /	/	+	/	2 hours after- wards pains for 2½ hours	Not examined	Blood clots in urine	Tbc renis dext
4	M	27	<sup>21/6</sup> 39 Stasis / Concrem /	++	++	½ hour after- wards pains for 2 hours	5 hours after- wards pains for 4½ hours	<sup>25/6</sup> 39 Stasis for 5½ hours on l side and 3 hours on r side	Blood clots in urine	Tbc renis dext
5	M	39	<sup>19/3</sup> 39 Stasis / Concrem /	++	+	1 hour after wards pains for 4 hours	—	<sup>20/3</sup> 39 Stasis for 5 hours on r side	No blood clots	Tbc renis sin
6	F	28	<sup>2/8</sup> 40 Stasis — Concrem —	++	++	—	2 hours after- wards pains for 5½ hours	<sup>23/8</sup> 40 Stasis for 5 hours on l side	Blood clots in urine	Tbc renis dext
7	M	45	<sup>30/10</sup> 40 Stasis — Concrem —	++	+	3 hours after- wards pains for 3 hours	—	<sup>1/11</sup> 40 Stasis for 4½ hours on r side	Blood clots in urine	Tbc renis sin
8	M	30	<sup>22/8</sup> 40 Stasis — Concrem —	+	+	—	2 hours after wards pains for 5 hours	<sup>22/8</sup> 40 Stasis for 5½ hours on l side	Blood clots in urine	Tbc renis dext

S	F	30	$\frac{22}{8}$ 40 Stasis - Concrem -	$\frac{30}{8}$ 40 + +	--	2 hours after wards pains for 5 hours	$\frac{30}{8}$ 40 Stasis for $5\frac{1}{2}$ hours on l side	No blood clots	Tbc renis dext
9	M	22	$\frac{2}{3}$ 40 Stasis - Concrem -	$\frac{2}{3}$ 40 + +	-	12 hours after- wards pains for 3 hours	$\frac{2}{3}$ 40 Stasis on l side for $3\frac{1}{2}$ hours	No blood clots	Tbc renis dext
10	M	40	$\frac{12}{1}$ 41 Stasis - Concrem -	$\frac{12}{1}$ 41 + +	3 hours after- wards pains for $3\frac{1}{2}$ hours	--	Not examined	Urine not ex- amined	Tbc renis dext
11	F	41	$\frac{21}{5}$ 41 Stasis - Concrem -	$\frac{21}{5}$ 41 + +	3 hours after- wards pains for $2\frac{1}{2}$ hours	--	$\frac{21}{5}$ 41 Stasis for $2\frac{1}{2}$ hour on r side	No blood clots	Tbc renis sin
12	M	32	$\frac{13}{7}$ 41 Stasis - Concrem -	$\frac{13}{7}$ 41 + +	1 hour and 16 hours after- wards pains for 3 hours and $4\frac{1}{2}$ hours	--	Not examined	Blood clots in urine	Tbc renis sin
13	M	34	$\frac{1}{2}$ 41 Stasis - Concrem -	$\frac{1}{2}$ 41 + +	2 hours after- wards pains for 3 hours	--	$\frac{1}{2}$ 41 Stasis for 4 hours on r side	$\frac{1}{2}$ 41 Cystoscopy Blood clots in r uretery opening	Tbc renis sin
14	F	21	$\frac{23}{9}$ 39 Stasis - Concrem -	$\frac{23}{9}$ 39 + +	$\frac{1}{2}$ hour after- wards pains for 2 hours	--	$\frac{23}{9}$ 39 Stasis for 2 hours on r side	Urine not ex- amined	Cystitis
15	F	19	$\frac{19}{4}$ 39 Stasis - Concrem -	$\frac{20}{1}$ 39 + +	1 hour after- wards pains for 6 hours	$1\frac{1}{2}$ hour after wards pains for 7 hours	$\frac{20}{4}$ 39 Stasis for 6 hours on r and l side	Blood clots in urine	Cystitis
16	F	41	$\frac{7}{9}$ 40 Stasis - Concrem -	$\frac{9}{9}$ 40 + +	--	2 hours after- wards pains for 4 hours	$\frac{9}{9}$ 40 Stasis for $4\frac{1}{2}$ hours on l side	Blood clots in urine	Cystitis
17	F	72	$\frac{27}{1}$ 40 Stasis - Concrem -	$\frac{28}{1}$ 40 + +	3 hours after- wards pains for 2 hours	3 hours after- wards pains for 2 hours	$\frac{28}{1}$ 40 Stasis for 3 hours on r and l side	No blood clots	Cystitis

Number	Sex	Age	Intravenous pyelography	Blood in urine by cath- eterization		Condition of pains after retraction of the urinary catheters		Intravenous pyelography after urinary catheterization with or without pains	Renewed cystos- copy during attack of pains Delivering of blood clots in urine	Diagnosis
				R side	L side	R side	L side			
18	I	38	17/10 Stasis Concrem	19/12 ++	10/10 +	1 1/2 hour after- wards pains for 2 hours		16 1/2 10 Stasis for 3 hours on r side	16 1/2 40 Cystoscopy Normal condi- tions 17 1/2 40 Blood clots in urine	Cystitis
19	I	20	4 1/2 12 Stasis Concrem	9/12 ++	12/12 ++	2 hours after wards pains for 3 1/2 hours		9/12 12 Stasis for 4 hours on r side	No blood clots	Cystitis
20	F	34	27/12 12 Stasis Concrem	29/12 ++	12/12 ++	1 1/2 hour after wards pains for 3 hours		29/12 42 Stasis for 2 1/2 hours on l side	Blood clots in urine	Cystitis
21	M	31	17/10 39 Stasis - Concrem	21/12 ++	39/39 ++	6 hours after- wards pains for 4 hours		21/12 39 Stasis for 4 hours on r side	Blood clots in urine	Pyelitis
22	M	39	20/12 11 Stasis Concrem	11/12 ++	39/39 ++	2 hours after wards pains for 1 1/2 hours	+	Not examined	No blood clots	Pyelitis
23	F	19	20/12 11 Stasis - Concrem	11/12 ++	11/11 ++	3 hours after- wards pains for 3 1/2 hours		20/12 41 Stasis for 4 hours on l side	No blood clots	Pyelitis
24	I	33	17/12 12 Stasis Concrem	12/12 ++	12/12 ++	1 hour after- wards pains for 5 hours		17/12 12 Stasis for 5 hours on l side	17/12 42 Cystoscopy Blood clots in urinary opening	Pyelitis

25	F	35	$19/2$ 42 Stasis — Concrem —	$20/2$ 42 ++	5 hours and 12 hours after- wards pains for 2 hours and 1 hour	Not examined	Blood clots in urine	Pyelitis
26	M	32	$19/3$ 42 Stasis — Concrem	$19/3$ 42 +	3 hours after- wards pains for $4\frac{1}{2}$ hours	$17/3$ 42 Cystos- copy Blood clots in r uretary opening	$17/3$ 42 Cystos- copy Blood clots in r uretary opening	Cysto- pyelitis
27	M	30	$28/3$ 39 Stasis — Concrem —	$30/3$ 39 — ++	4 hours after- wards pains for 3 hours	$30/3$ 39 Stasis for 3 hours on l side	No blood clots	Cysto- pyelitis
28	F	58	$28/11$ 39 Stasis — Concrem —	$29/11$ 39 +	2 hours after wards pains for 1 hour	$29/11$ 39 Stasis for $2\frac{1}{2}$ hours on l side	Blood clots in urine	Cysto- pyelitis
29	F	26	$30/5$ 40 Stasis — Concrem —	$30/5$ 40 ++ --	12 hours after wards pains for 5 hours	$31/5$ 40 Stasis for 5 hours on r side	No blood clots	Cysto- pyelitis
30	F	58	$28/8$ 40 Stasis — Concrem —	$29/8$ 40 — +	2 hours after wards pains for 3 hours	$29/8$ 40 Stasis for $2\frac{1}{2}$ hours on l side	Blood clots in urine	Cysto- pyelitis
31	F	49	$10/2$ 41 Stasis — Concrem —	$12/2$ 41 — +	6 hours after- wards pains for 3 hours	$11/2$ 41 Stasis for 4 hours on l side	Blood clots in urine	Cysto- pyelitis
32	F	41	$31/2$ 42 Stasis — Concrem —	$1/3$ 42 + ++	2 hours after- wards pains for 3 hours	$1/3$ 42 Stasis on l side for $3\frac{1}{2}$ hours	$1/3$ 42 Cystoscopy Normal condi- tions Blood clots in urine	Cysto- pyelitis
33	M	33	$25/7$ 41 Stasis — Concrem —	$28/7$ 41 ++ --	5 hours after wards pains for 1 hour	$28/7$ 41 Stasis for 2 hours on r side	No blood clots	Epidid- ymitis chr

time Thus the pains appeared from  $1\frac{1}{2}$  to 6 hours in 30 cases Only twice after 12 hours and once after 16 hours Average time after about 3 hours With two of the patients the pains reappeared after an intermission of several hours The duration of the pains varied from 1 to 7 hours, average time about 3 hours

During ureteral catheterization more or less admixture of blood in the urine from the two ureteres occurs in almost all cases In this work only the macroscopic admixture has been considered In table 3 values according to the degree of admixture are given — + denotes slightly visible admixture, + distinct admixture with redcoloured urine, and ++ very much blood in the urine The urine has been collected in 6 test-tubes from each side The bleeding often occurs after 1—2—3 quite clear glasses Very often the admixture of blood is increasing from glass 1—6 The bleeding is probably due to small lesions of the ureteral mucous membrane and of the irritation of the catheters during the ureteral peristaltic They have never been put so far up that the kidneys might have been injured Greater lesions as rupture of ureter, as described by HENLYNDE and DEAN LEWIS have not been observed

It now appeared that the pains usually occurred where the bleeding was most excessive during the collection of the catheteral urine In the cases where pains occurred the urine continued to be mixed with blood after the catheters were removed A fairly constant relation between the admixture of blood and the pains has also been observed, so that by great admixture the pains were more intense By small admixture or quite clear urine, no pains occurred By hæmaturia with unknown origin where the bleeding pertains to the pathologic picture, no pains were as a rule observable

In most of the cases blood clots have systematically been sought for in the urine, and they have several times been observed after the pains have stopped, most frequently with the typical formation of ureteral blood clot

It can be taken for granted, that blood clots arise anywhere in the ureter The blood clot may be localized by the nature of the pains The most characteristic symptom is that the pains, either from the beginning or at the end, will be found in the inguinal region In accordance herewith the blood clot will either be moving downwards, or be found in the lower part of the ureter

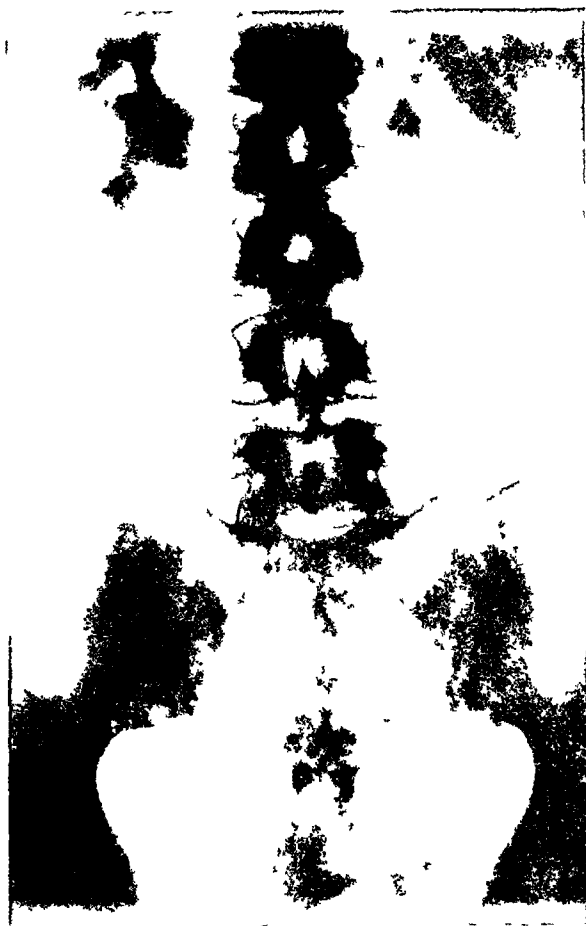


Fig 1 No 16 Table I Woman, 41 years old Diagnosis Cystitis  
 2 hours after catheterization of the ureters, pains on left side for 4 hours,  
 and stasis on the same side for 4 1/2 hours Delivered blood  
 clots in urine





Table II.

*62 observed cases without pains after retraction of the uretary catheters*

Total number of cases	Blood in urine by uretary catheterization				Intravenous pyelography after uretary catheterization	Stasis	Delivering of blood clots in urine	Diagnosis
	—	— +	+	++				
14	1	8	4	1	4	0	0	The renis
15	12	3	0	0	6	0	0	Cystitis
10	9	1	0	0	2	0	0	Cystopyelitis
8	6	2	0	0	2	0	0	Pyelitis
3	0	0	3	0	1	0	0	Hæmaturia
7	6	1	0	0	2	0	0	Gonorrhoe and scabies
2	1	1	0	0	0	0	0	Epididymitis the
1	1	0	0	0	0	0	0	Pyonephrosis
2	2	0	0	0	2	0	0	Dysuria neu-rosa
62	38	16	7	1	19	0	0	

the average time was 9 hours. At the later stages respectively 33 and 44 hours after the attack of stone had started.

Partial ruptures of ureter, as mentioned by DEAN LEWIS and HENLYNDE could have been demonstrated by the subsequent urography.

Vicinal tumors or abscesses would have caused stasis by the first intravenous pyelography as well. Gravidity does not occur in this material.

By allergical reactions on the contrast means, functional disturbances, as mentioned by HULTBORN, may appear with excessively reduced secretion of the contrast substance. He refers to a case where, besides the shock, only a secretion of the contrast substance in the kidney itself appeared similar on both sides, but no secretion in pelvis renis or calyces even if "rest" nitrogen was normal. These conditions, however, are not accompanied by pains and they must also have appeared by the first intravenous pyelography.

The most probable cause is the formation of blood clots which

for a time obstruct the ureter. This is supported by the findings of blood clots in urine after cessation of pains, and above all by the fact that blood clots in ureterostoma have several times been observed at cystoscopy during attacks. When the clots are removed, the pains and stasis cease. This is moreover supported by the blood-containing urine on the side where the pains and stasis appear. It is possible that a small concrement was the primary origin of bleeding and the formation of blood clots, and that it would be found like a kernel in the clot. Concrements have, however, systematically been sought for in all blood clots, but the result was negative.

Spasms in the lower part of ureter, which may arise by irritation from the catheters, will not alone account for stasis. At most they will form a contributory cause, while the formation of blood clots will remain the central one.

### Summary.

The author mentions the pains which occasionally appear after cystoscopy with ureteral catheterization and is of the opinion that the probable cause is blood clots, which settle down in the ureter. A series of examinations of 95 cases is mentioned, all of which were first examined by intravenous pyelography. After the ureteral catheterization 33 of them got pains. In 19 of these cases blood clots were observed either by renewed cystoscopy, or in the urine. Blood clots cause the stasis, and this stasis has been observed by renewed urography in 28 out of the 33 cases.

### Zusammenfassung

Verf. erwähnt die Schmerzen, die ab und zu nach Zystoskopie mit Ureterenkatheterisierung auftreten, und ist der Ansicht, dass die Ursache wahrscheinlich in Blutgerinnseln zu suchen ist, die sich im Ureter festsetzen. Es wird eine Reihe von Untersuchungen an 95 Fällen erwähnt, die alle vorher mittels intravenöser Pyelographie untersucht worden waren. Nach der Ureterenkatheterisierung bekamen 33 von ihnen Schmerzen. Bei 19 dieser Fälle wurden Blutgerinnsel beobachtet, entweder bei erneuter Zystoskopie oder im Harn. Die Blutgerinnsel riefen eine Stauung hervor, und diese Stauung wurde bei 28 der 33 Fälle bei erneuter Urographie beobachtet.

### Résumé.

L'auteur commence par rappeler les douleurs qui apparaissent parfois après la cystoscopie avec cathétérisation des uretères, il pense que la cause probable en sont des caillots arrêtés dans les uretères. Il rapporte une série d'examens pratiqués sur 95 cas qui furent tous examinés préalablement par pyélographie intraveineuse. 35 d'entre eux présentèrent des douleurs après la cathétérisation des uretères. Dans 19 de ces derniers, on observa des caillots soit en répétant la cystoscopie soit dans l'urine. Les caillots sanguins provoquent une stase, cette stase a été observée en répétant l'urographie dans 28 des 35 cas.

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## Percaine Spinal Anæsthesia Combined with Evipal Narcosis.

By

GERHARD FIEHN

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Since BIER produced the first spinal anæsthesia in 1898 surgeons all over the world have been striving to improve the results of this form of anæsthesia which once promised to become the ideal method, at least in surgery below the diaphragm. It has been attempted to avoid — or at any rate reduce — the disadvantages of spinal anæsthesia, partly by improving the technique, partly by finding more suitable anæsthetic agents. Furthermore, it has been tried in combination with various other methods of general and local anæsthesia. Percaine, produced in 1929, has the advantage over and above the various agents which so far have been employed for spinal anæsthesia, that it secures the longest duration. It is generally used in  $\frac{1}{2}$  per cent solution (QUARELLA) or 1 in 1500 dilution (JONES, SEBRECHTS).

The literature contains extremely few reports of spinal anæsthesia combined with intravenous anæsthetics. KEES of the U S A has reported satisfactory results in 50 cases applying novocaine spinal anæsthesia combined partly with evipal, partly with pentothal (not used in Denmark), the former said to be preferable on account of its less inhibitory effect on the respiration. According to KEES the purpose of this combination is to avoid preliminary medication, to supplement the depth and possibly also the duration of the anæsthesia, and to avoid agitation on the part of the patient during the operation. The spinal anæsthesia is administered *after* the patient has become unconscious.

In gynecologic laparotomies WERNER of Vienna employs the following technique, originally recommended to him by the

Argentine MARTINEZ DE HOZ Percaine spinal anaesthesia is administered with one-half of the usual dose or less (0.8 cc of 1/2 per cent solution) which *per se* only exceptionally affords a sufficient anaesthesia. Thereupon intravenous anaesthesia with eunarcon. The procedure is said to result in a muscular relaxation equally effective as in spinal anaesthesia with ordinary dosage.

In Scandinavia spinal anaesthesia combined with evipal narcosis has been used by WESTERBORN who emphasizes the advantages that the patients are spared lying awake during long and exhausting operations, that nausea and vomiting are avoided, and that the great advantage of spinal anaesthesia, complete muscular relaxation, at the same time is preserved.

A few other authors, *v. a.* ADAMS and WIDENHORN, also have mentioned spinal anaesthesia combined with intravenous narcosis.

Since January 1940 percaine spinal anaesthesia combined with evipal has been in increasing use at Diakonissestiftelsen, Department B, and now it may be said to be the routine method in all major surgical interventions below the diaphragm.

### Technique.

The technique has been as follows. Before the patient is transferred to the operating room he is injected with tetrapon (of a composition similar to pantopon »Roche«), 1 1/2 cc (2 per cent solution) and ephedrine, 10 cg, subcutaneously. Only half a dose of ephedrine is administered, if the systolic blood pressure is between 150—200, and none at all, if it is above 200. The anaesthetic is injected with an ordinary, slender spinal needle generally between lumbar III and IV, occasionally between II and III or IV and V. The patient is placed in the lateral position, the spine being horizontal, the head somewhat lowered, and the affected side upwards. Without a preceding withdrawal of cerebrospinal fluid, percaine 1:1500 (»Ciba«) is injected evenly and slowly (not more than 4 cc in the minute). The volume to be injected is calculated on the basis of the sex of the patient and the length of the spine measured from the vertebra prominens to the intercrural line according to the following table (JONES)

Table I.

Length of spine cm	Percaïne 1 1500, cc	
	Male	Female
56	18	16
54	17—18	15—16
52	17	15
50	16	14
48	15	13
46	14—15	12—13
44	13—14	11—12
42	13	11
40	12	10

After the injection the stilette is fitted into the needle as a stopper and about 5 and 10 minutes later the height of the analgesia is tested by means of a tenaculum forceps, Péan's forceps, or a similar implement. If the analgesia proves to be too low it is supplemented with 2—6 cc of the percaïne solution which is sufficient in the vast majority of cases. The needle is removed, the patient is turned (if desired) on his back and is placed in a horizontal position or a few degrees Trendelenburg. A needle is inserted percutaneously into a cubital vein where it may be fixed with some sticking plaster. The needle is prolonged with a slender rubber tube, about 10 cm in length and provided with metal mouth pieces, fitting the needle at one end and a Record syringe at the other. The needle is kept passable by means of physiologic salt solution injected with an even pressure with a 10 cc syringe. Thereupon the narcosis may be started, when desired, in this material as a rule about 20 minutes after the beginning of the first percaïne injection, by injecting evipal sodium (evipan-natrium »Bayer«) in a 10 per cent solution from another 10 cc syringe. The volume injected per minute should not exceed 1 cc but often the initial dose is 2 cc. The dosage of evipal is determined according to the condition of the patient, the aim as a rule being just to keep the patient asleep, maybe only dozing. The general practice in major surgery is to administer about 1 litre of saline solution intravenously. In our opinion the various forms of a more or less complicated apparatus recommended to protract evipal injection is superfluous. The rubber tube permits of an easy changing of syringes without dislodging the needle from the vein. When inserting the needle it is important to ascertain that it is not stuck in the posterior wall of the vein, but freely movable.

somewhat further up. In order not to mistake one syringe for the other, it is advisable to tie a piece of red cotton to the evipal syringe or use a 20 cc syringe for the saline solution.

In case the medical staff of the department is limited in number, the anaesthesia may be accomplished in the following manner without loss of time. Before changing, the 1st assistant of the operation administers the spinal anaesthesia, according to the table, with sterile gloves. He then changes and scrubs his hands (by the method of HANS WULFF). After this process which takes 10—12 minutes, he tests the height of the analgesia and supplements it with the necessary dose of percaine. While he washes in spirit the patient is turned on his back, the field of operation is prepared and a graduate inserts a needle for the injection of evipal into a cubital vein and waits for a signal from the operator, as a rule given 1—2 minutes before the incision is made. The evipal injection is started and the patient has fallen asleep immediately before the skin incision is made, as a rule 20 minutes after the first and 8—10 minutes after the second percaine injection.

### Material.

During the period January 1940 to July 1944 the above combination of percaine spinal anaesthesia with evipal was used in 500 instances. Evipal has, however, been substituted by citodan sodium (»Leo«) since January 1943 without any difference being demonstrable in the effect (cf. HOLMÉN). Table II sets out the distribution of the material as regards sex, age, and operative site. The youngest patient was a female, aged 17, the eldest a male aged 78.

As to the effect of the anaesthesia the material may be divided into 3 groups: ideal, comprising 456 cases (91.2 per cent), moderate and poor. The last-mentioned group consists of 3 cases (0.6 per cent) which at an early juncture required a supplementary ether anaesthesia. (1) A male, aged 39, submitted to pyelolithotomy. On account of violent excitation he had to be given ether after having received 9 cc evipal in the course of 10 minutes, (2) a female, aged 30, (supravaginal hysterectomy) who did not display relaxation or regular anaesthesia after 8 minutes' administration of evipal, 15 cc, (3) a male, aged 31, (partial gastrectomy) who strained a good deal and was rather cyanosed after the administration of 9 cc evipal in the course of 10 minutes.

Table II.

A g e	<20		20-29		30-39		40-49		50-59		60-69		70-79		Total
	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀		
Stomach			2	1	10	2	17	5	6	5	7	3	1	1	60
Biliary ducts				6	5	16	6	22	8	21	3	14		3	104
Intestine + abd wall															
above the navel			1			2	3	3	2	7	4			2	27
below " "				2	1	2	3	6	3	5	4	8	2	1	37
Kidney, ureter				1	4	1	3	4	2	2	2	2			21
Bladder, prostate							1		3	1	3	2	3		13
Appendix	4	1	11	7	10	2	9	4	8	1	3	1	1		62
Female genitals															
abd				15		35		44		23		7		2	126
vag						7		9		18		5		1	40
Inguinal and crural hernia								2							2
Rectum, anus							2			1				1	6
Lower limbs				1				1							2
Total { ♂		4		4		27		37		29		27		7	131
♀	4			37		75		107		86		48		12	369

The limit between the two first-mentioned groups, the ideal and the moderate ones, has been drawn critically, all cases in which the anæsthesia has given cause to the slightest objection (not, however, including a fall of blood pressure) being assigned to group 2 which thus contains 41 cases (8.2 per cent). The majority (21 cases) consisted of unsatisfactory relaxation of the abdominal wall, 6 vomited one or several times during the operation (in 3 cases, however, resulting from pulling on the stomach and in 2 in the form of a single slight vomiting which caused no inconvenience), in 4 cases the evipal produced a mild excitation, in one case, however, quickly subsiding into a quiet narcosis, and one case exhibited spasms attended with a mild cyanosis. 6 patients reacted by a slight whimpering or in a manner not further specified, and finally in 4 cases the needle inserted into the vein gave trouble, for which reason a minor amount of drop-ether had to be administered.

The percental distribution of groups 2 and 3 according to age is recorded in Fig. 1. It is evident that the anæsthesia gave the poorest results among men and during the age 30—49, furthermore that all the poor results were observed in the case of patients in their thirties.

As might be expected, a study of the incidence of groups 2 and 3 reveals that the majority (32) were observed during inter-

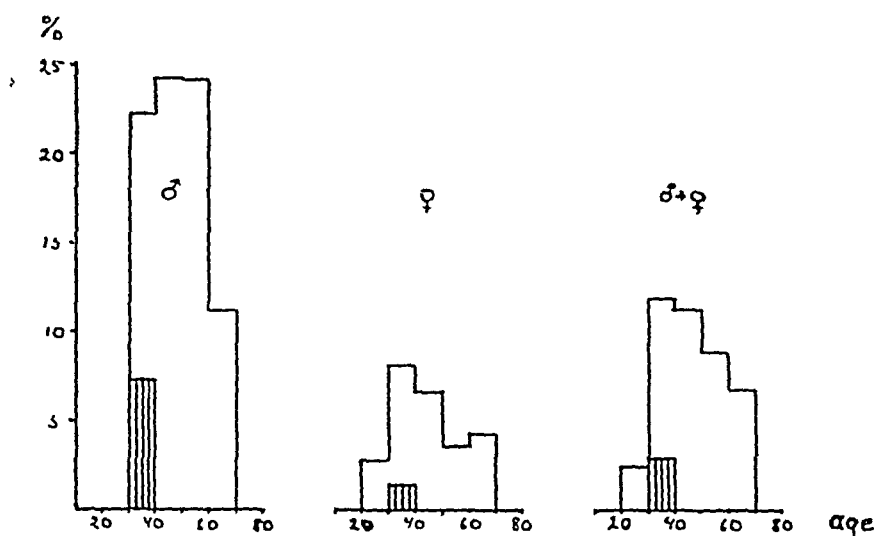


Fig 1 The percentage of poor (shaded areas) and moderate anesthetics within the individual age groups

ventions above the umbilicus, 17 moderate and 1 poor result occurring among the gastric operations (i. e. 30 per cent of the latter) and 13 moderate ones among the operations on the biliary system ( $12\frac{1}{2}$  per cent). Among the sub-umbilical operations, 126 gynecologic laparotomies included 4 moderate and 1 poor result (4 per cent) and appendicectomies 5 moderate ones (8.1 per cent).

Only in 2 cases did the duration of the narcosis exceed a short time after the patient had returned to the ward. After having received 10 cc evipal a 41-year old woman was by mistake given an additional quantity of 5 cc in one stage towards the end of an operation which had lasted for an hour (supravaginal hysterectomy). Following the administration of coramine, 5 cc  $\times$  2 she recovered somewhat, but was deeply asleep. The pulse remained unaffected, and she woke up 4 hours later. The other patient was a 59-year old woman who did not awake until 6 hours after the injection of evipal, 9 cc, during an operation for ventral hernia.

If the duration of the anesthesia is to be judged by the time at which the patient feels the legs "awake", the average duration is 4.1 hours, independent of age and sex. The shortest duration was half an hour in the case of a 45-year old female, submitted to cholecystectomy. The percaine dose was 12 + 5 cc, resulting in analgesia extending somewhat above the costal margin (in the mammary line). The longest duration was 9 hours in a female,

aged 41, operated upon for inguinal hernia. The percaine dose was 13 cc, resulting in analgesia reaching to the umbilicus.

The dose, as far as percaine was concerned, averaged 19.4 and 17.0 cc in men and women respectively in the case of interventions above the umbilicus and 16.7 and 15.9 in sub-umbilical operations. The largest dose 16 + 4 + 6 + 6 cc was administered to a male, aged 37, who was submitted to partial gastrectomy. After the first 16 cc the analgesia reached as far as the iliac spine, and it could not be extended further up in spite of a new puncture in a higher intervertebral space for the administration of the last 6 + 6 cc. An ideal anæsthesia was, however, obtained by evipal (11 cc in 80 minutes). Smallest dose 10 cc was given twice, once to a female, aged 58, (operation for prolapse of the uterus). An ideal anæsthesia was obtained by the use of 2 cc of evipal. The other patient was a male, aged 71, (resection of the rectum) who was kept in a constant light narcosis with 20 cc of evipal in the course of 87 minutes.

Table III

Age	Evipal dose		
	♂	♀	♂+♀
<20	—	6.8	6.8
20—29	16.5	8.8	9.6
30—39	12.3	9.0	9.9
40—49	12.1	8.1	9.1
50—59	8.9	7.5	7.9
60—69	8.6	6.9	7.5
70—79	8.2	4.5	5.7

The average dose of evipal was 8.6 cc (men 10.6 cc and women 7.9 cc). Table III gives the dose employed for the various age groups. It will be seen from the table that — apart from the youngest patients — the dose decreases with advancing age, exactly in accordance with the diagram in Fig. 1. 23 patients slept satisfactorily on 3 cc evipal, 15 on 2, and one patient even on 1 cc. 5 times the dose of evipal exceeded 20 cc, the largest dose being 26 cc administered to a 43-year old man, submitted to partial gastrectomy (of 1¾ hours' duration). In this case 17 + 4 cc of percaine had resulted in an analgesia extending to a site somewhat above the umbilicus. An impression of the quantities of percaine and evipal used in the most common operations will be gained by regarding Table IV, which does not include the cases which had to be supplemented with ether.

Table IV.

			Quantity of percame			Quantity of evipal			Duration of operation		
			largest	smallest	average	largest	smallest	average	longest	briefest	average
Partial gastrectomy	♂		32	17	20 3	26	10	16 7	150	55	92
	♀		19	12	16 3	20	10	15 0	120	45	86
	♂+♀				19 8			16 4			91
Cholecystectomy (+ Choledochotomy)	♂		21	15	18 8	17	4	10 1	95	25	42
	♀		23	13	17 1	20	2	8 2	75	18	33
	♂+♀				17 4			8 6			35
Appendicectomy	♂		20	15	18 1	18	2	9 2	75	8	33
	♀		19	12	15 6	14	2	6 0	45	15	26
	♂+♀				16 4			7 1			28
Supravaginal ectomy	hyster	♀	20	12	16 3	17	2	8 8	75	20	37

### Complications ARIISING DURING the Anæsthesia.

The blood pressure in most cases remained rather constant in spite of limited usage of the Trendelenburg position, at any rate the steep degrees. If the relative fall of blood pressure (ALS-NIELSEN), i. e. the difference between the lowest blood pressure recorded and the normal blood pressure of the patient, stated in percentage of the latter, is taken to represent the effect on the blood pressure, it will be seen that 266 (86.9 per cent) of the 306 patients whose case records gave a possibility of calculating the relative fall of blood pressure, did not exceed 30 per cent, 33 (10.8 per cent) exhibited a fall of 31—50 per cent, and only 7 (2.3 per cent) exceeded 50 per cent.

As a general rule the fall of blood pressure did not cause any inconvenience and each time the blood pressure could be raised by injecting ephedrine. Only in a few cases was there a question of collapse. (1) A female, aged 72, who was operated on for volvulus. She had received 15 cc percame and 1 cc evipal. When the operation was started she was almost in a state of collapse, and the pulse was nearly impalpable. After the administration of ephedrine and coramine, however, she quickly recovered and slept quietly during the entire operation. (2) A female, aged 54, (supravaginal hysterectomy). Percame, 13 cc, gave analgesia extending some-

what above the navel, immediately followed by collapse attending with vomiting. Following the administration of ephedrine she recovered and received 10 cc of evipal in the course of 30 minutes without further inconvenience. (3) The only death "on the table" should be mentioned in this connexion. The patient was a 65-year old man who was admitted in a rather debilitated state suffering from ileus. Shortly after admission an explorative laparotomy revealed a high-lying rectal cancer, for which reason a colostomy was established. He had received percaine, 15 + 3 cc, resulting in analgesia extending to the costal margin (in the mammary line) and evipal, 6 cc, in the course of 45 minutes. The blood pressure fell once to 60, but again rose after administration of ephedrine. The general condition was satisfactory with a good, quiet sleep. When closing the abdomen (after about an hour) 10 cc of 20 per cent saline solution were administered intravenously (as a stimulant?). A violent peristalsis immediately set in and the distended intestinal coils could only be kept inside the abdomen with difficulty. An enormous amount of fæculent fluid was vomited and the patient died. On the basis of the available data it is difficult to say whether it was a question of direct suffocation or whether the vomiting is to be interpreted as an agonal phenomenon, but it does not seem improbable that the saline injection bears the main responsibility for the fatal issue.

As might be expected a survey of the factors influencing the blood pressure based on the information to be obtained from the case records reveals that the fall of blood pressure is independent of the absolute amount of percaine injected, whereas it seems to have some relation to the height of the analgesia limit. If the analgesia extended to the costal margin or higher the relative fall of blood pressure thus averaged 13.2 per cent, and 10.2 per cent in the case of analgesia below the costal margin. The relationship is not, however, distinct, the percentage *c g* being merely 8.7 in the case of the 8 patients with an analgesia limit above the ensiform process.

Table V aims at showing whether the injected quantity of evipal has influenced the relative fall of blood pressure. It appears that, practically speaking, there is a completely negative correlation between the total evipal dose and the average, relative fall of blood pressure. But considering that the lowest blood pressure, which forms a basis for the calculation, is recorded at a time before the total amount of evipal has been injected, the negative

findings do not justify conclusion, and regrettably the case records do not contain data as to the amount of evipal injected at the time

Table V.

Evipal	rel fall of bl pr
0—5	18.2
>5—10	11.3
11—15	6.9
16—20	4.1
>20	—6.0

The time at which the maximum fall of blood pressure occurred among the 7 patients (6 females and 1 male) with a relative fall of blood pressure exceeding 50 per cent was 5, 5—10, 10, 15, 20, 35, and 40 minutes after the administration of the spinal anaesthesia, *i. e.* even before the first 5 patients had received evipal. The remaining 2 patients had received a total of 5 and 4 cc evipal in the course of 60 and 21 minutes respectively, in other words a quite slight amount.

Table VI.

*Rel fall of bl pr*

Age	♂	♀	♂+♀
<20	—	5.0	5.0
20—29	—2.0	7.1	6.7
30—39	2.1	7.7	6.2
40—49	6.5	11.6	10.6
50—59	9.1	14.1	13.2
60—69	15.5	18.6	17.1
70—79	28.0	12.6	19.8

According to Table VI, presenting the relative fall of blood pressure within the various age groups, the tendency to a reduced blood pressure increases with advancing age. When comparing the figures with Table III we perhaps arrive at an explanation of the figures in Table V, seeing that the requirement of the older age groups for evipal is less, but their vasolability greater.

In most cases no major changes were demonstrable in the respiration, maybe a slight tendency to increased frequency. Two patients had a transitory, mild cyanosis and shallow breathing, subsiding in both cases after intravenous administration of cora-

mine,  $2 \times 2$  cc.. In the case of a 43-year old woman (cholecystectomy with choledochotomy) who had received 18 + 5 cc. percaïne and  $5\frac{1}{2}$  cc. evipal in the course of 45 minutes, resulting in an excellent anæsthesia (analgesia reaching to the costal margin), the respiration failed for a few minutes, while the pulse remained steady, about 3 hours after the administration of the spinal anæsthesia. Intracardiac (!) administration of lobeline re-established a lasting, good respiration.

The combined anæsthesia, according to our experience, has not affected the respiration to a greater extent than the pure spinal anæsthesia in use during the preceding years.

The pulse also remained almost unchanged, apart from the above-mentioned cases of collapse.

Vomiting was observed a few times after the administration of spinal anæsthesia, but *as a rule it ceased as soon as the patient fell asleep*. Only 4 patients went on vomiting after the evipal injection had been started, 3 during cholecystectomies and one during the establishment of a gastroenterostomy.

Excitation was observed 4 times (1 woman and 3 men), once so violent that ether had to be resorted to. One of the patients was used to drinking large amounts of alcohol.

Spasms occurred twice during the evipal narcosis, but neither tremor nor clonic convulsions were observed. Discharge of urine or feces did not occur during the operations.

### Post-operative Complications.

All the patients were questioned as to headache. The result is set out in Table VII. The comparatively mild headache affecting

Table VII.

Headache	♂	♀	♂+♀
mild (1st—2nd day)..	4 (3.1 per cent.)	33 (8.9 per cent.)	37 (7.4 per cent.)
moderate .....	3 (2.3 " " )	5 (1.4 " " )	8 (1.6 " " )
severe .....	1 (0.8 " " )	3 (0.8 " " )	4 (0.8 " " )

a number of the patients probably has no relation to the anæsthesia in contradistinction to the moderate and severe ones, moderate meaning a headache of several days' duration which, however,

as a rule has subsided before the patient gets up. The following 4 cases were classified as severe.

(1) A female, aged 37, who received 12 cc percame and 8 cc evipal during an operation for prolapse of the uterus. Headache localized to the forehead on the first morning. Severe headache from the 13th post-operative day until discharge on the 21st day, out of bed on the 15th day. (2) A female, aged 43, who received 14 + 3 cc percame and 7 cc evipal during a supravaginal hysterectomy. Some headache on the first day, out of bed on the 15th post-operative day. When up and about she suffers from a headache, localized to the back of the head, which yields to bed rest. (3) A male, aged 31, who received 17 + 3 cc percame and 8 cc evipal during an appendicectomy. Some headache each forenoon. The headache persisted, but was subsiding at an after-examination on the 22nd day. (4) A female, aged 45, who received 12 + 5 cc percame during a cholecystectomy. On the 16th day there was headache which returned after she "fainted" and possibly hurt her head, when she got out of bed on the 21st day. A headache, localized to the back of the head, persisted for 2 days. The headache in this case was of a rather functional nature.

All the cases of moderate, and severe headache occurred among the patients below 50, and did not, unlike the mild headaches, predominate among the women.

Rachialgia was not observed, nor was meningitis, but the case records of a 68-year old woman, submitted to abdominoperineal resection of the rectum for a cancer, contain the observation that she exhibited a strange stiffness in the neck on the 3rd day. She could not swallow but did not display other pareses. She died in a state of hyperpyrexia on the 3rd day. Autopsy was not performed.

Paresthesia occurred in one patient on the 7th day, localized to the radial side of the right thumb, without other disturbances of the radial nerve. The evipal injection had left a hæmatoma in the right cubital fossa.

Table VIII

*Not including interventions on the bladder, prostate, vagina, and rectum*

Retention of urine	♂	♀	♀+♂
Total	14 (11.8 per cent)	120 (38.6 per cent)	134 (31.2 per cent)
> 24 hours	4 (3.1 " " )	63 (20.3 " " )	67 (15.6 " " )
> 7 days	0	8 (2.6 " " )	8 (1.9 " " )

Table VIII records the patients who suffered from post-operative retention of urine. All the patients submitted to interventions on

the bladder, prostate, vagina, and rectum have been omitted. It is evident that, apart from the first 24 hours, these disturbances almost exclusively were encountered in women. In 8 cases the condition lasted for more than a week, for 8, 10, 11, 13, 13, 14, 14, and 18 days respectively. The comparatively large number of cases perhaps in part is explicable by the rather wide use of morphine medication during the first post-operative days (generally  $1\frac{1}{2}$  cc tetrapon, 2 per cent, 3 times daily during the first 48 hours).

Otherwise pareses were not observed.

**Phlebitis** occurred once in the cubital vein used for the evipal injection. The same patient later developed a phlebitis of the lower limbs. Moreover, 6 patients had a manifest phlebitis, 5 died of embolism and 5 had pulmonary infarcts.

**Pneumonia** was a post-operative complication in 4 cases, 3 of which had a fatal outcome on the 2nd, 9th, and 11th day respectively.

There were 3 cases of post-operative hæmorrhage, all with fatal issue.

(1) A female, aged 48, died on the 4th day after a cholecystectomy, presumably from hæmorrhage following the removal of the meche. Autopsy not performed. (2) A male, aged 36, who also died on the 6th day after a cholecystectomy + transduodenal choledochotomy. Autopsy. Severe, intra-abdominal hæmorrhage, severe, acute hepatic degeneration. (3) A female, aged 56, submitted to abdominosacral resection of the rectum. Feeling comparatively well during the first couple of hours, but then developed a small and rapid pulse and died from hæmorrhage 4—5 hours later in spite of the administration of stimulants.

As already mentioned there was 1 death even before the operation was concluded. Besides, 4 patients died in the course of the first 24 hours. One has already been mentioned under post-operative hæmorrhage, one died of pulmonary oedema 9 hours after the operation. The autopsy revealed a severe cardiac degeneration and arteriosclerosis. A 73-year old woman, submitted to entero-anastomosis on account of a cancer at the hepatic flexure, followed an even downhill course after the operation, without waking properly. The pulse was rapid and small, the blood pressure remained at about 100, and death occurred 7 hours after the operation. The operation had been extremely difficult, the intestinal wall was exceedingly decayed, and large quantities of fæces escaped into the abdomen. Finally, a 46-year old man died, less than 24 hours after an operation for ileus, with a severe peritonitis.

### Discussion.

The procedure of combining percaine spinal anaesthesia with evipal secures the advantage of both methods and, if anything, reduces the risks. It preserves the relaxation of the abdominal wall, so important to the successful accomplishment of the intervention, and avoids extending the spinal anaesthesia to dangerous heights, *i. e.* requires a smaller amount of anaesthetics. When the patient is asleep he does not strain with the diaphragm, a movement which may be troublesome during interventions in the upper abdomen. The vomitings which often accompany high spinal anaesthesia and traction on the organs are less frequently encountered in the combination anaesthesia, and in a number of cases vomitings arising in connexion with the spinal anaesthesia have ceased as soon as the patient has fallen asleep on evipal. The combined anaesthesia often requires a surprisingly small dose of evipal, and the extent of the effect which has been reported to occur on the respiration seems to be far from greater, neither quantitatively nor qualitatively, than in case of spinal anaesthesia alone, even though the latter does not exceed the costal margin. In addition, it is an extremely humane form of anaesthesia. It is of great importance to surgeon as well as patient that the latter is asleep, being awake during a lengthy operation amounting to a psychic trauma not to be neglected (BIERRING). According to the experience gained in the Department, dread of anaesthesia is an unknown phenomenon among the patients who undergo several operations under the combination anaesthesia. Lastly, it is of some significance that a needle is left in the vein, and should a critical condition arise, the anaesthetist is able to institute intravenous medication (coramine, oxedrine, blood etc.) without delay, apart from the constant stimulation with saline.

The drawbacks of the method are *i. a.* that it is somewhat more circumstantial than for instance spinal anaesthesia by the method of QUARELLA, but on the other hand it is quicker than SEBRECHTS' method. The administration of the spinal anaesthesia as a rule takes about 10 minutes. Furthermore, it requires an anaesthetist, preferably fairly experienced, besides a nurse at the head of the patient. The nurse can, at the same time, control the blood pressure at the other arm. The apparatus required, on the other hand, is so simple that it affords no difficulty.

Other objections imaginable are (1) The administration of the

spinal anæsthesia in the lateral position might result in a unilateral anæsthesia. In practice, the analgesia limit proves to run along a line, which perhaps often is inclined, but seldom deviating more than a few degrees from the horizontal plane. At the same time the patient is spared the prone position used in anæsthesia by the methods of SEBRECHTS and JONES. (2) The tendency of spinal anæsthesia to cause a fall of blood pressure might be supported by the evipal which by some authors is reported to be of a blood pressure reducing effect. This is the reason why *e g* ANSCHUTZ warns against the combination. The present material does not, however, seem to afford a support for this presumption. It is true that, by contrast to the 0.4 per cent reported by ALS-NIELSEN, a relative fall of blood pressure exceeding 50 per cent occurred in 2.3 per cent of the patients, but firstly the anæsthetic used was not the same, secondly the Trendelenburg position was not as widely used in the present material, and — apart from these facts — the difference is not quite definite statistically. In addition, a number of other factors contribute to the fall of blood pressure, not least the intra-abdominal manipulations. (3) The risk of respiratory disturbance (OSTERGAARD) would not directly seem to be great, since the effect, if any, of spinal anæsthesia on the respiration is peripheral and not via the respiratory centre like that of evipal. In cases in which the spinal anæsthesia is high enough to threaten the respiration, the amount of evipal required to keep the patient asleep as a rule is quite small. The 3 only cases in which the respiration was perceptibly affected have already been mentioned, and accordingly the risk seems to be extremely slight. The last case, however, urges the necessity for caution in the dosage and careful observation of the patient, also after the operation. (4) Other complications do not seem to be more frequent than in the case of spinal anæsthesia alone. As far as headache is concerned, the figures, if anything, are below those usually reported, and 2 of the 4 cases classified as severe were not particularly serious. Maybe the comparatively good result is ascribable to the infusion of saline solution. Vomiting during the operation decidedly occurred more rarely than usual, a fact which maybe is due to a great part of these vomitings being caused by apprehension which of course ceases during the narcosis. Neither does the number of pulmonary complications and phlebitis seem to have been unreasonably large. An exception is formed by the bladder

disturbances which occurred rather frequently Without a control material it is hardly possible to ascertain whether this condition is due exclusively to the rather lavish use of post-operative morphine medication

As mentioned above the **indications** were nearly all major interventions below the diaphragm, in a few cases even extended to minor interventions like operations for hallux valgus in nervous patients This form of anæsthesia is particularly suitable for difficult abdominal interventions, especially gastric operations for which a really good anæsthetic has been missing hitherto (ABRAHAMSEN)

The **contra-indications** are the usual ones for evipal and spinal anæsthesia liver damage, shock conditions, and severe morbus cordis, sepsis, tuberculosis, and syphilis Besides, the indications presumably should not be extended to comprise children

Briefly summarized the advantages are the following (1) The method affords ideal working conditions in abdominal surgery, also above the navel, without necessitating the extension of the spinal anæsthesia to dangerous heights, (2) it seems to combine the advantages and reduce the risks of both substances (3) it is humane, especially for anxious patients, (4) should a critical condition arise, a needle is lying in a vein, and no time is lost in finding the way into a vein which maybe is collapsed, (5) the patient receives saline solution already during the operation, (6) no complicated apparatus An additional advantage is that (7) the anæsthesia lasts even after the patient has woken up from the evipal narcosis, a fact which secures a more placid awakening

The only drawback of any importance is the demand for an extra assistant to administer the evipal which should not be given by a nurse

### Summary.

The author reports 500 spinal anæsthesias using percame, 1 in 1500 dilution, combined with evipal narcosis The technique is described in detail In 91·2 per cent of the cases the effect was ideal, and another form of narcosis had to be resorted to in 0·6 per cent only The effect was poorest among men and the age groups 30—49 as well as in interventions above the navel The dose required of each substance was less than in the case of percame spinal anæsthesia alone or evipal narcosis alone

Reviewing the complications the author arrives at the result that the action upon blood pressure, respiration, and pulse hardly has been more marked than in each form of anæsthesia alone. Vomiting occurs more rarely than in spinal anæsthesia alone. Among post-anæsthetic complications headache was rare (0.8 per cent. relatively severe), whereas a comparatively large number of patients exhibited post-operative retention of urine (in 15.6 per cent. exceeding 24 hours) which, however, may be due to lavish morphine medication. 1 death which perhaps is ascribable to the combination anæsthesia, occurred before the operation was concluded, and 4 deaths occurred during the first 24 hours. The anæsthesia presumably is not to blame for any of the last-mentioned deaths.

The essential advantages of the combination anæsthesia are the ideal working conditions afforded in abdominal surgery, not least above the navel, the method combining the advantages of the two forms of anæsthesia without increasing the risks, and the humane character of the method, especially in the case of anxious patients.

### **Zusammenfassung.**

Verf. berichtet über 500 Lumbalanästhesien mit Perkam 1:1500, kombiniert mit Evipan-Narkose. Die verwendete Technik wird eingehend besprochen. Die Wirkung war in 91,2 % ideal, und nur in 0,6 % sah man sich genötigt, auf andere Narkose überzugehen. Am schlechtesten war die Wirkung bei Männern im Alter von 30—49 Jahren sowie bei Eingriffen oberhalb des Nabels. Man kam in bezug auf beide Substanzen mit geringeren Dosen zurecht, als bei reiner Perkam-Lumbalanästhesie oder Evipan-Narkose.

Die Komplikationen werden besprochen, und es wird gezeigt, dass Blutdruck, Atmung und Puls kaum starker beeinflusst werden als bei jeder der beiden Anästhesieformen einzeln. Erbrechen kommt seltener vor als bei reiner Lumbalanästhesie. Von den postanästhetischen Komplikationen kamen Kopfschmerzen selten vor (in 0,8 % relativ schwere Schmerzen), während Miktionsbeschwerden verhältnismässig oft auftraten (bei 15,6 % mehr als 24 Stunden lang), was jedoch vielleicht durch reichliche Morphinmedikation bedingt ist. Es kam 1 Todesfall vor Abschluss der Operation vor, der vielleicht der Kombinations-

anästhesie zuzuschreiben ist, sowie 4 Todesfälle in den ersten 24 Stunden, für die die Anästhesie anscheinend in keinem Falle angeschuldigt werden kann

Die wichtigsten Vorzüge der Kombinationsanästhesie sind, dass sie bei abdominalen Eingriffen, u. a. auch oberhalb des Nabels, ideale Arbeitsbedingungen schafft, indem sie die Vorzüge der beiden Betaubungsformen in sich vereinigt, ohne die Gefahren zu vermehren, sowie dass sie human ist, besonders wenn es sich um angstliche Kranke handelt

### Résumé.

L'auteur expose les résultats de 500 cas d'anesthésie lombaire à la percaine à 1 1500 combinée à la narcose à l'évipan. Il décrit minutieusement la technique. Dans 91,2 % des cas l'effet a été idéal et dans à peine 0,6 % des cas il a fallu recourir à une autre forme de narcose. L'effet a été le moins favorable chez les hommes âgés de 30 à 49 ans dans les interventions sus-ombilicales. Pour les deux substances on a pu diminuer les doses usuelles pour la narcose à l'évipan seul ou l'anesthésie lombaire à la percaine seule.

L'auteur passe en revue les complications et démontre que l'action sur la pression sanguine, la respiration et le pouls a été à peine plus prononcée que dans chacune des formes d'anesthésie employée seule. Les vomissements sont plus rares que dans l'anesthésie lombaire pure. En fait de complications post-anesthésiques, le mal de tête a été rare (relativement pénible dans 0,8 % des cas) accompagné de troubles de la miction dans un assez grand nombre de cas (dans 15,6 % des cas plus d'un jour), symptôme peut-être attribuable à un usage abondant de morphine. On a observé un cas de mort avant la fin de l'opération peut-être attribuable à l'anesthésie combinée et 4 cas de mort dans les journées suivant l'opération, dont aucun ne semble devoir être attribué à l'anesthésie.

Parmi les avantages principaux de l'anesthésie combinée, on peut citer d'abord les conditions idéales de travail qu'elle fournit dans les interventions abdominales, même sous-ombilicales, parce qu'elle combine les avantages des deux méthodes sans augmenter les risques, puis, la sécurité qu'elle donne aux malades angoissés.

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## List of Authors.

von Bahr, V 139  
 Bartels C D 1  
 Brandberg, R 37  
 Brattstrom E 377  
 Bukh, H 507

Crafoord, C 481

Efskind, I. 419

Feltstrom, E 349  
 Fiehn, G 557  
 Frostad, H 546  
 Frykholm R 368, 451

Grevillius, Å 309

Hendelberg, Th 339

Hjort, E 115  
 Hulten, O 228

Jakobsen, A 199  
 Jonsson, G 533

Landgren, Å 481  
 Lund, J 291

Magnusson, R 162, 259  
 Manicus-Hansen, E 1

Nilzen, Å 285

Olovson, Th 331

Palmer, I 387  
 Petersen, K E 86  
 Petren, G 150

Quist-Hanssen, Sv 393

Saarenmaa, E 403  
 Sand, K 470  
 Sandberg, I R 99  
 Sletvold, K 115  
 Sulamaa, M 65

Troell, L 180

Wahren, H 327  
 Wiklander, O 17  
 With, T K 507  
 Wulff, H 470  
 Vuori, E 231

Zacho, A 278



<i>Erik Brattstrom</i> (Helsingborg) Duodeno-gastrectomie dans les Cas compliqués d'Ulcère pénétrant et de Tumeurs perulcerées	377
<i>Ivar Palmer</i> (Stockholm) A Peculiar Bone Tumor	387
<i>Sv Quist-Hanssen</i> (Bergen) Caput Necrosis after Traumatic Dislocation of the Hip Joint in a 4-Year Old Boy, and Control Examinations of 8 Cases of Luxatio Coxae Traumatica	393
<i>Erik Saarimaa</i> (Finland) Die Läsion der Bauchspeicheldrüse im Zusammenhang mit der Splenektomie und das Fieber nach dieser Operation	403
<i>Leif Efskind</i> (Oslo) Edema in Surgical Patients	419
<i>Ragnar Frykholm</i> (Stockholm) Treatment of Bilateral Acoustic Tumors	451
<i>Hans Wulff et Knud Sand</i> (København) Sur la prothèse testiculaire après la castration légale	470
<i>Clarence Crafoord und Åke G. H. Lindgren</i> (Stockholm) Mucous and Salivary Gland Tumours in the Bronchi and Trachea	481
<i>Holger Buhl und Torben K. With</i> (København) Splenectomy in Chronic Non-leukemic Myeloid Splenomegaly with Report of a Case with Osteosclerosis	507
<i>Gosta Jonsson</i> (Lund) Hæm Acute Haematogenous Osteomyelitis Become Less Common and Less Severe?	533
<i>H. Frostad</i> (Ålesund, Norge) Urinary Stasis and Pains after Cystoscopy with Catheterization of Ureters	546
<i>Gerhard Fiehn</i> (København) Percaïne Spinal Anaesthesia Combined with Ethyl Narcosis	557

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Supplementum 98 <i>Mauritz Perisson</i> (Varberg) Pathogenese und Behandlung der Kienbockschen Lunatummalazie Die Frakturtheorie im Lichte der Erfolge operativer Radiusverkürzung (HULTÉN) und einer neuen Operationsmethode — Ulnarverlängerung
Supplementum 99 <i>P. I. Tuominen</i> (Helsinki) Über die angeborene Hftverrenkung, insbesondere über die Indikation und Heilungsergebnisse der geschlossenen und offenen Behandlung
Supplementum 100 <i>Sommar Bruzelius</i> (Lund) Dicoumarin in Clinical Use Studies on its Prophylactic and Therapeutic Value in the Treatment of Thrombo-Embolism
Supplementum 101 <i>Gunnar Bergquist</i> (Uppsala) Changes in Blood in Connection with Thrombo-Embolism An Investigation Regarding Operation and Delivery
Supplementum 102 <i>Torsten Gårdh</i> (Stockholm) Postural Circulatory and Respiratory Changes during Ether and Intravenous Anesthesia An Experimental Analysis of the Significance of Postural Changes during Anesthesia with Special Regard to the Value of the Head-down Posture in Resuscitation
Supplementum 103 <i>Lars Holmberg</i> (Stockholm) Fractures in the Distal End of the Humerus in Children
Supplementum 104 <i>L. Engstrand and O. Friberg</i> (Stockholm) On the Function of the Liver as Affected by Various Operations and Anesthetics

